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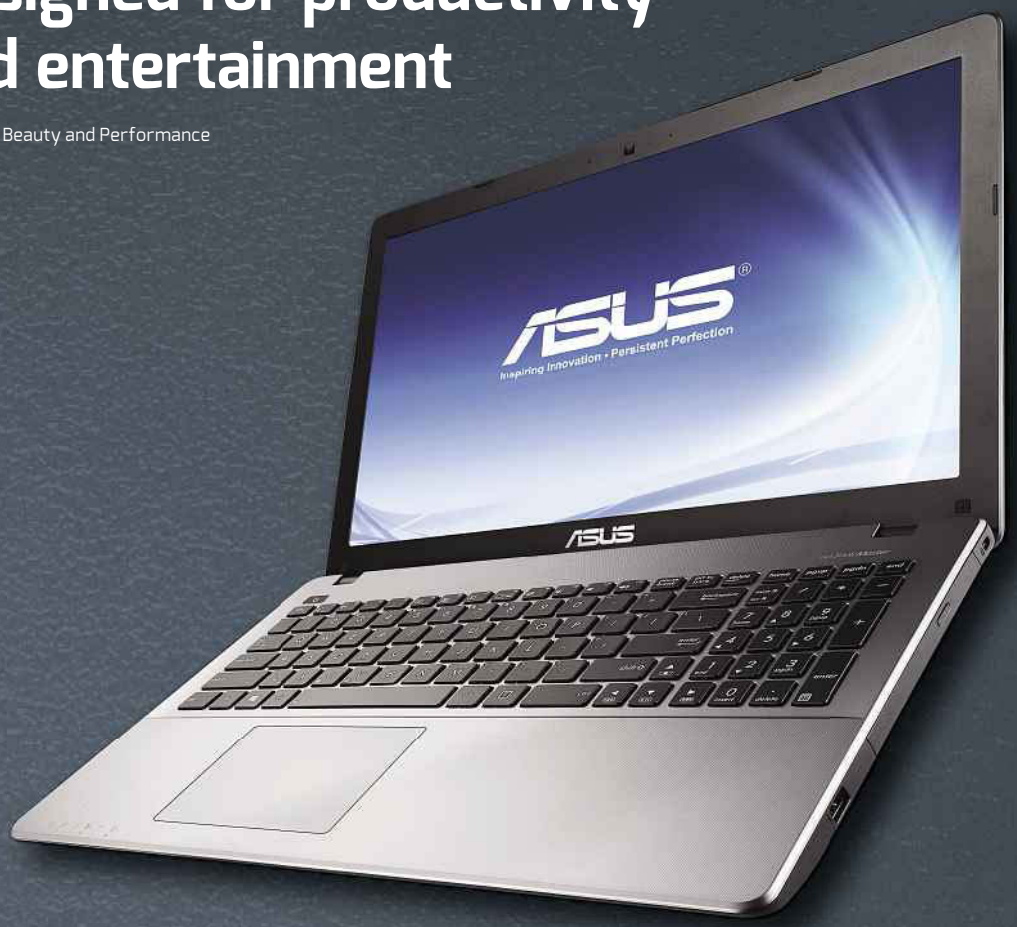
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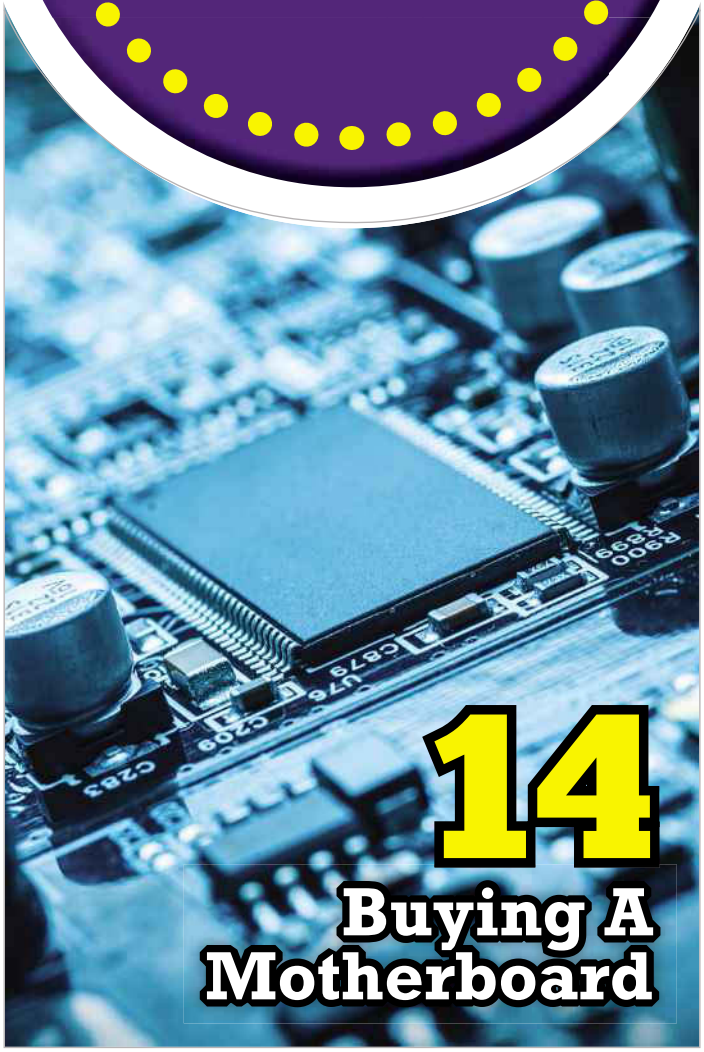
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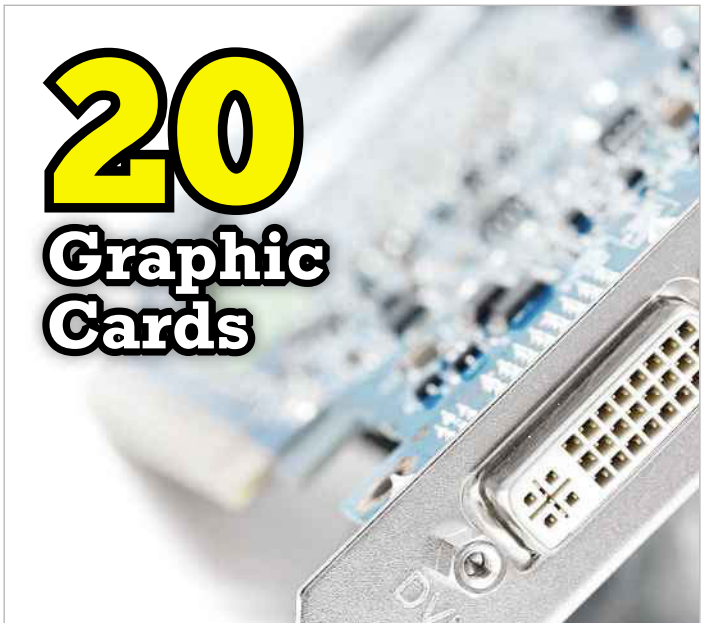
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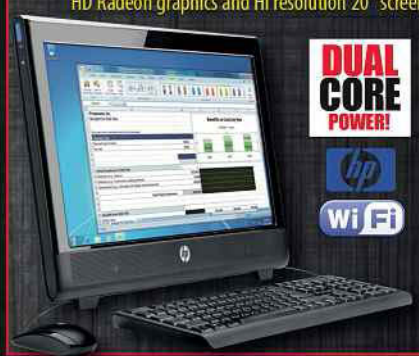
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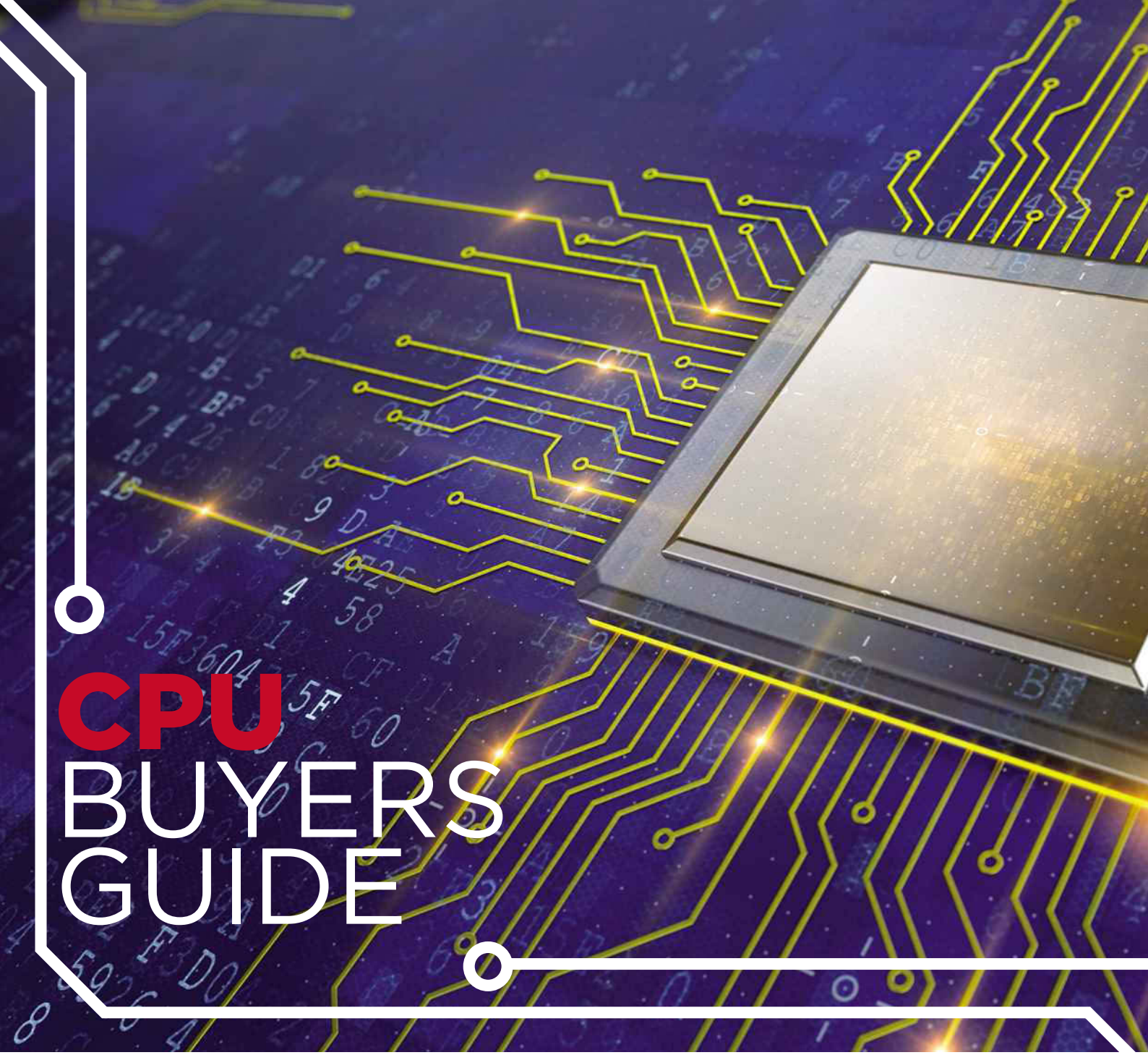
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CPU BUYERS GUIDE

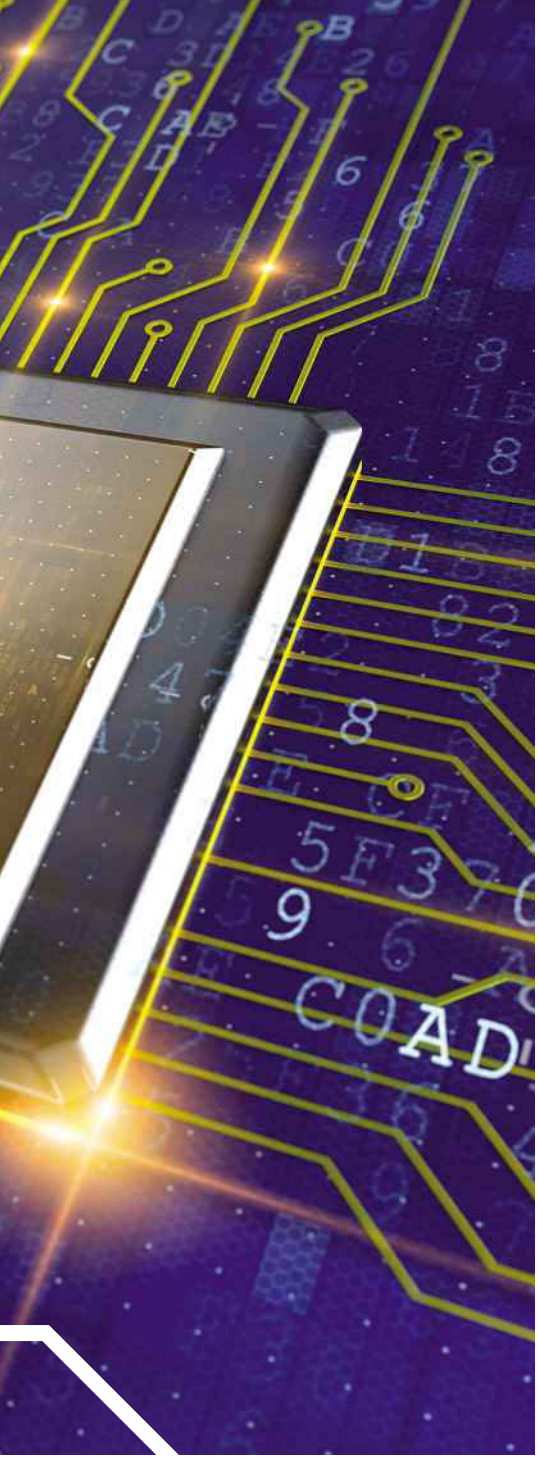
If you're in the market for a new processor, this guide is for you...

Buying a processor can be a difficult task. A fast-changing market coupled with a constant flow of new innovations and technologies (some real, some just for marketing purposes) can leave you struggling to even understand the options available to you.

The first question that needs to be answered is why you should spend money on a processor at all, when you could spend your money on any upgrade. More RAM, a solid-state drive, a better graphics card – they all have the potential to improve your computing experience and squeeze more power out of your machine. Why spend the cash on a processor?

Well, plugging a new processor in your computer is the easiest way to revitalise an ailing machine. You don't have to spend hours cleaning out old software and defragmenting hard drives. You don't have to tweak registry settings or install helper applications. From the moment you switch your computer back on, it'll be immediately faster and more capable.

There are downsides, of course. Processors can only be upgraded so far before you need to buy a new motherboard that contains the latest CPU socket and platform designs, and the installation of a



“The big decision most buyers face is whether they should shell out for an Intel chip or go for an AMD equivalent”

new motherboard can have knock-on effects tantamount to buying a new computer entirely (which is why vendors often sell motherboards, processors and RAM as a bundle). So how do you determine which processors you should buy and how far they can be stretched before you have to spend even more money on an upgrade?

Between Carizzo’s recent delay and Intel’s latest Skylake release, the CPU market has once again changed, and that means it’s time to re-evaluate what you’re looking for in a processor and whether it makes sense to upgrade your platform, your chip or wait and see what’s coming next.

CPU Architecture

Processor architecture is a tough area to understand, with a lot of different technologies and capabilities competing to appear the most crucial. Is a 2GHz dual-core faster than a 1.8GHz quad-core? Which is the best socket and why? It’s not always easy to know. So what are you actually looking for when you buy a CPU?

Although it may be interesting to some users on a technical level, the fact is that you can’t really divine performance from the number of cores or the clock speed alone. AMD chips have more cores than Intel chips, but they’re built differently, so a quad-core AMD chip isn’t the same as a quad-core Intel chip. Likewise, a 3GHz AMD chip isn’t necessarily better than a 2GHz Intel chip.

The main thing to remember is that for modern CPUs, the number of cores and clock speed is now only of any significant importance when comparing two processors from the same line. If you’re looking at two Intel chips, then more cores and a faster clock speed probably means it performs better.

Perhaps the most interesting thing to look at is the chip’s ‘process’. This value will be referred to in nanometres, and refers to the size of features created during the fabrication process. For complicated physics reasons, the smaller the fabrication process, the more energy-efficient a CPU is, meaning it’s usually faster and cooler than an otherwise identical chip with a larger process. All things being equal, the smaller fabrication is more desirable than the larger one.

Regardless of the amount of cores, clock speed or fabrication process, the ability to overclock a chip may also sway you. Any CPU with a ‘K’ suffix can be overclocked from its factory speed (provided the motherboard supports overclocking), so you can garner additional speed by looking for that feature.

Finally, CPU socket types are sometimes worth paying attention to, but not always. Although CPU sockets are designed to allow you to reuse them and upgrade your chip, it’s not unusual to find the socket deprecated by the time you come to upgrade. For this reason, people who upgrade infrequently need give little thought to the socket type when buying a processor (save for making sure it fits in the motherboard you buy).

Users at either extreme of the usage spectrum, however, may want to get the most current socket to allow for easy upgrades. Low-end users may find that spending a few extra pounds buying the latest socket will allow them to improve their computer’s speed in the future without the need to buy a new motherboard as well, while high-end users will want to buy the latest chips as soon as they’re available. In any case, socket type is mostly a compatibility issue, and unrelated to performance in any major way.

Intel Vs AMD

The big decision most buyers face is whether they should shell out for an Intel chip or go for an AMD equivalent. In recent years AMD has struggled to match Intel’s pace, but that doesn’t mean there isn’t a place for it in the market.

Whichever one you choose, it’ll dictate a number of other choices about your system – its features, its motherboard and RAM type, maybe even the type of graphics card you buy. And while they do the same thing, both processors take very different approaches to the task, which means they suit different types of users. So how do you choose?

Price is the place where most people start thinking about building their PC. AMD processors are uniformly cheaper than their Intel equivalents, although this doesn't necessarily equate to them being better value in performance terms. When you compare raw CPU power, Intel's chips outclass any AMD chips at the same price range by a significant amount. So if low price is more important than good value, AMD is a good choice, but only at the low end where Intel chips are significantly stripped back.

The decision becomes more complicated when you start to consider on-board graphics. The majority of Intel chips (but especially those at the low end of the market, which either have no on-board GPU or a very weak one) have worse GPUs than their AMD equivalents. Even when it comes to mid-range chips such as the Core i5 and the AMD A10, the latter's graphics performance is better.

What this means is that if you're building a gaming system, a mid-range Intel chip and a graphics card will perform about as well as a high-end AMD chip on its own, and the latter will be cheaper than buying the former two. This means that for budget gaming, AMD chips can't be beaten. But if you have a graphics card of moderate capability already, an Intel chip will be a better investment – unless your graphics card is a Radeon *and* can be run in CrossFire mode with the GPU on an AMD chip.

Confused? We hope not, but you may want to re-read that paragraph to make sure.

"AMD chips have more cores than Intel chips, but they're built differently"

Even Intel's latest graphics technology, the Iris Pro (which appears in Skylake chips) isn't quite a match for AMD's on-board GPUs. But if you're buying a Skylake chip, then it's likely that price isn't your primary concern, and high-end chips need high-end graphics cards to get the best performance out of them anyway.

It's also worth noting that if you're *not* building a gaming PC, then Intel's on-board graphics are probably sufficient to run your system on. Non-gaming applications tend to benefit more from Intel's fast CPU speed than AMD's extra GPU capacity, so if you're just putting together a general use desktop machine, we'd go for Intel in virtually every case.

If you're building a system for other specialist use, then you may want to take into account a few other factors. System temperature is important in HTPCs and other compact systems, so chips with a low TDP are more desirable. AMD chips have a higher TDP than Intel chips, partly because its chips are less efficient. If keeping temperature low matters to you, Intel's hardware will give you better results on that front. It's hard to say which chip is 'best', but easier to say which is best for you.

Current Models

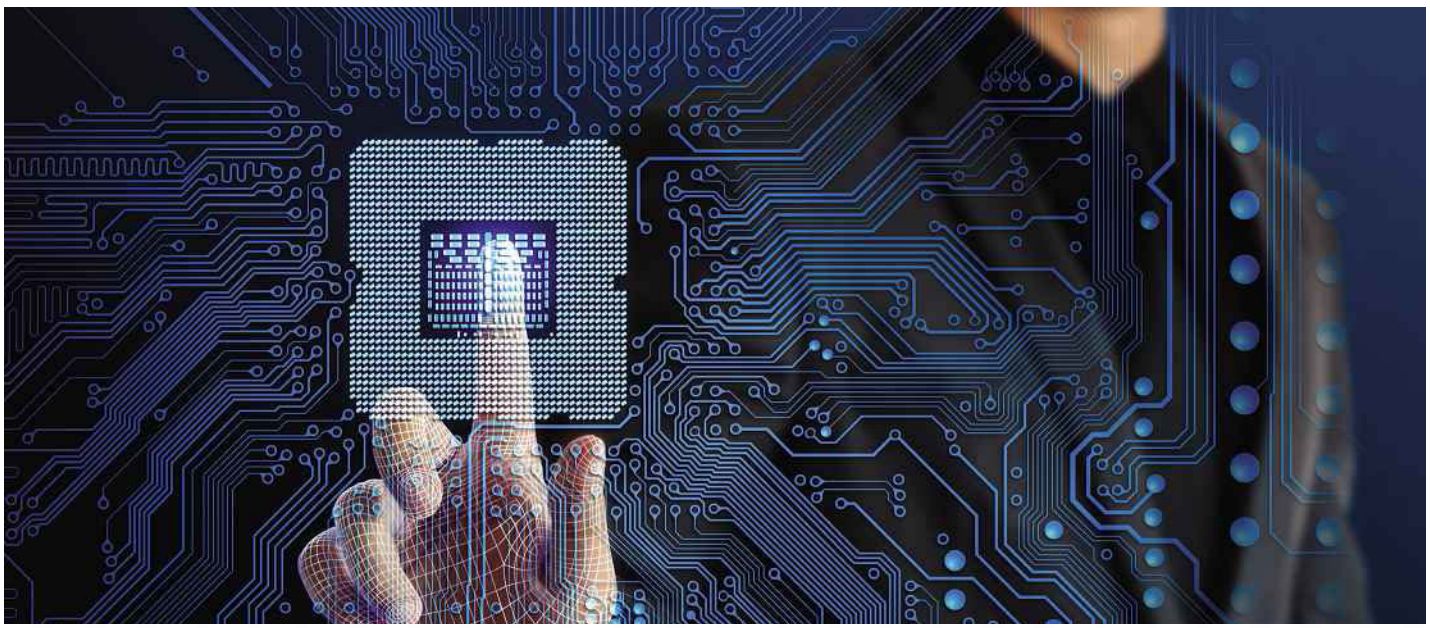
If it's been a while since you bought a CPU, you might be wondering what the CPU landscape currently looks like. Here, we'll explain the sort of terms you'll encounter and which of them are worth looking out for.

- ***Intel: Ivy Bridge***

Released in 2011, Ivy Bridge is Intel's first line of 22nm processors, which used Socket 1155 interfaces. You can tell an Ivy Bridge chip by its model number which, in standard consumer chips, usually begins with a 3 (e.g. Intel Core i7 3770K). The last Ivy Bridge chips were released in September 2013, and at this point we wouldn't recommend upgrading to one even if you can find them on sale!

- ***Intel: Haswell***

The follow-up platform to Ivy Bridge was released in 2013 and still uses a 22nm process, but contained other improvements which made it around 10% faster. They use Socket 1150 interfaces and can be denoted by their 4-series model numbers (e.g. Core i5 4690K). Unlike most recent chip releases, Haswell's successor (Broadwell) did not have a full desktop release, making the platform unusually prominent over the last two years. A refresh in 2014 introduced the 'Devil's Canyon' variants, which had improved thermal performance and required Intel 9-series motherboards. If you're looking at older Intel chips, a Devil's Canyon Haswell would be the oldest we'd recommend.



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“If you’re not building a gaming PC, then Intel’s on-board graphics are probably sufficient to run your system on”

• *Intel: Skylake*

Since most of Intel’s first 14nm chips from 2014, code-named Broadwell, were only available in mobile devices, the successor to Haswell is 2015’s Skylake. These are also 14nm chips, and they use Socket 1151 on Intel 100-series motherboards. At present there are only a few Skylake CPUs on the market, but this will increase dramatically over the next year. They can be recognised by the 6000-series model numbers, such as the Core i5 6600K.

Intel has just delayed its Cannonlake 10nm CPU line, so if you’re buying a new chip for the long haul and can afford the latest hardware, we strongly recommend buying a Skylake CPU. Beware, however, that it’s still new enough that there’s a slight premium, and that performance isn’t significantly better than Haswell chips unless you’re also using the integrated graphics (which have been substantially improved). You will, however, get support for DDR4 RAM, which makes Skylake a smart investment in the future of desktop computing.

• *Intel Chip Lines*

Within each of the Intel platforms, you’ll find a variety of lines for each chip. Pentium and Celerons are low-end budget chips designed for very light use and low-budget systems. They’re aimed more at things like simple office PCs and point-of-sale hardware than home multimedia systems. For light home use, we’d encourage you to buy a Core i3 at the very least. If you’re building a gaming system, the Core i5 should suffice. Core i7 chips are mainly aimed at extreme computing enthusiasts, and cost a significant premium over the alternatives, especially at the high end. Only buy a Core i7 if you’re sure you know why you want one!

• *AMD: Kaveri*

AMD has effectively ceased production of its stand-alone FX chips for the time being, leaving its combination CPU and GPU platform – the APU – as the only real option for CPU-buyers. Kaveri APUs were released in 2014 and use 28nm Steamroller architecture. They’ve just started to be replaced by their successor, Carizzo, on mobile platforms, but are still popular on the desktop. Indeed, the latest chip refresh (code-named Godavari) came out in Q2 and Q3 2015, so they’re still well up to date. They use FM2+ motherboards and can be recognised by their 7000-series model numbers (e.g. A8-7650K).

Due to the delays and uncertainty around Carizzo, we recommend anyone wedded to the idea of buying AMD chips sticks with Kaveri for the time being. They’re cheap and competitive on price and power for any system that doesn’t have a stand-alone GPU as well, and that makes them worth considering.

• *AMD: Carizzo*

The Carrizo line of chips includes Excavator cores (succeeding Steamroller) and a new generation of GPUs. They will also be the first to support DDR4 memory, making them good for transitioning to a new platform. At present, the desktop variety is not expected until some time in 2016 and will be code-named Bristol Ridge.

Carizzo chips have a 28nm process, meaning AMD won’t be shifting to 20nm CPUs for another generation. Carizzo chips are expected to have 8000-series model numbers and use FM2+ sockets.

However, if you’re running an AMD system and want to upgrade to another one, then Carizzo is probably not going to be much use to you in the short term. Whatever comes next – code-named AMD Zen – is going to be so different from Carrizo that there’s little chance of salvaging the core components, and if you don’t upgrade now, it’s going to mean a long and pointless wait for your next AMD system.

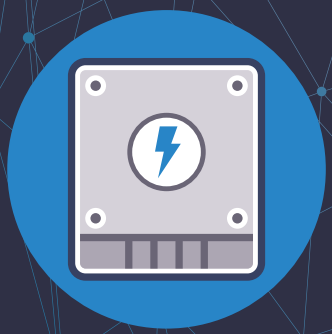
The good news is that it’ll be a while now until any new chips are on the market, and that makes it a good time to buy your upgrades. Whether you buy Intel or AMD chips, you should easily get four to six months of them being the best you can get, if not longer. And when it comes to something as expensive as CPUs, hardware that holds its value is a rarity worth chasing. **mm**

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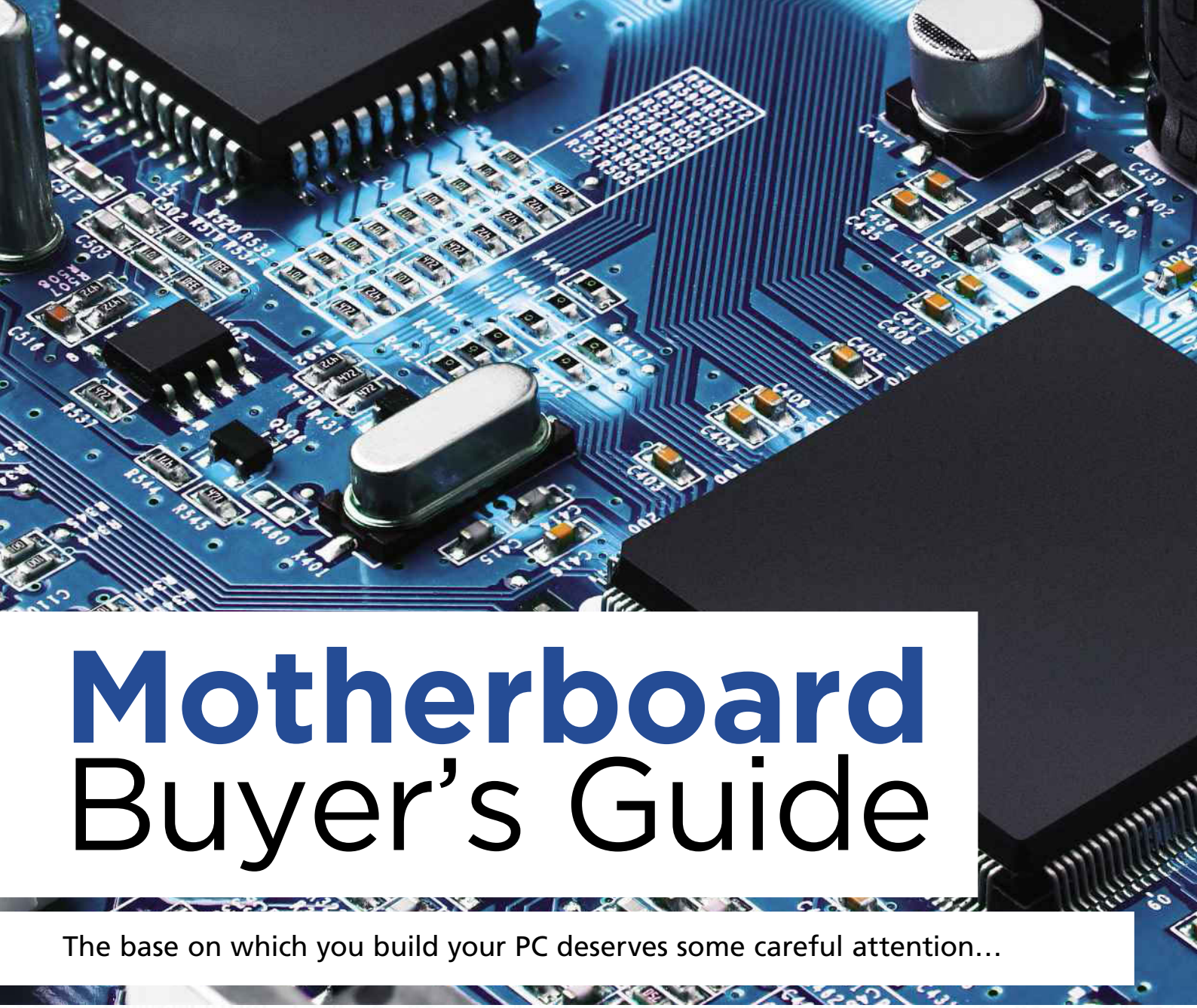
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Motherboard Buyer's Guide

The base on which you build your PC deserves some careful attention...

Whether you're planning to build or upgrade a PC, choosing the right motherboard is important in making sure you can get the most out of your CPU and GPU. As well as unlocking the capabilities of your most expensive components, motherboards dictate how upgradable your current system is. With the wrong motherboard, you can run out of space for RAM or lose compatibility with the latest processor releases. Upgrading your motherboard isn't just about getting immediate results; it's about the results it allows you to get in the future.

But motherboards are packed with technologies that have some of the most confusing names and model numbers in the industry, and they can seem practically impenetrable if you've been out of the upgrading game for a few years. That's why this guide will tell you exactly what to look for depending on the type of system you're building and the sort of hardware you want to put in with it.

Motherboard Hardware

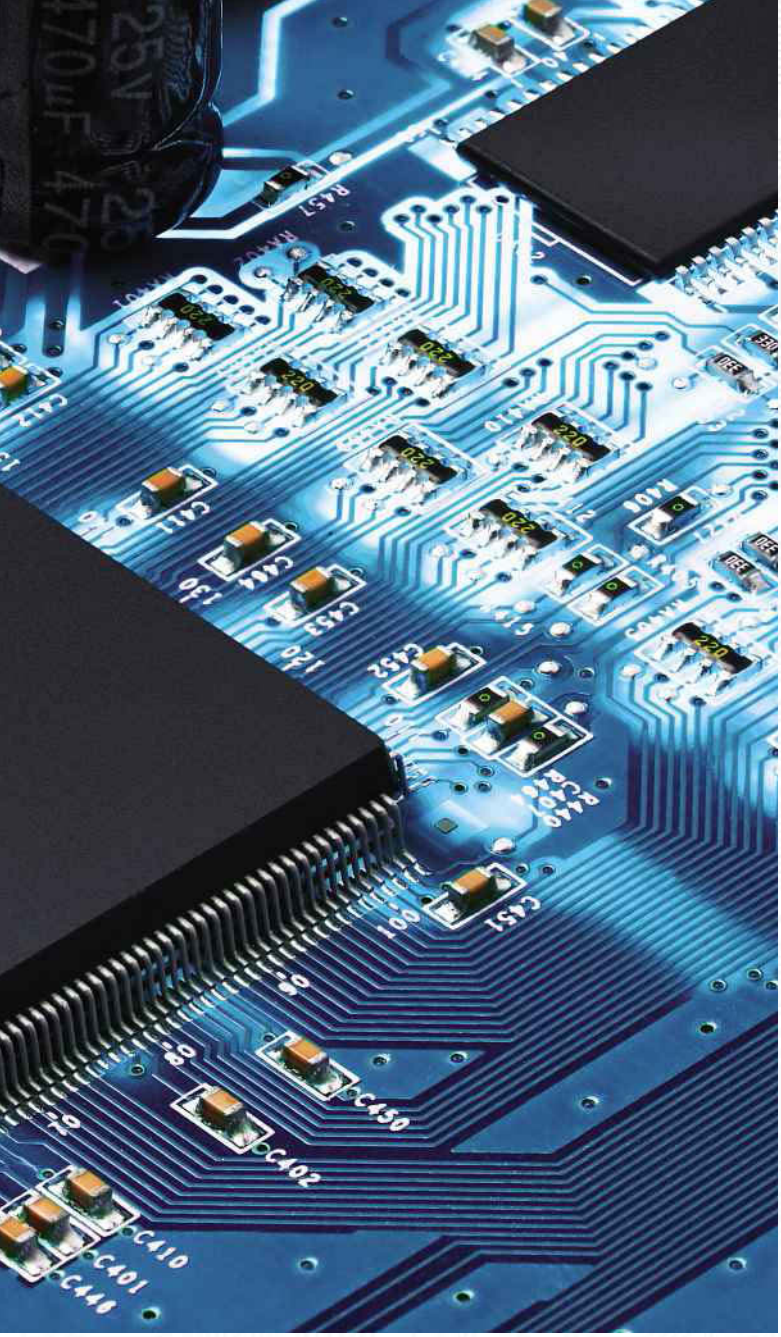
If you're buying a new motherboard, you could start by selecting one that's compatible with your existing CPU. Whether you're upgrading your chip or not, making sure you have the correct socket is important. While most hardware can be convinced to work with any modern motherboard through converters or expansion cards, nothing will let you get a CPU into a motherboard it's not designed for.

There are several sockets you'll find on a motherboard that determine the type of chip it takes. Some sockets are associated with multiple chipsets, giving them backwards compatibility. For example, Devil's Canyon Haswell CPUs could only access their full range of features in the upgraded Socket LGA1150 boards, but all LGA1150 boards were compatible with a Devil's Canyon Haswell chip to some extent.

Once you've narrowed your choices down to a motherboard that supports your preferred chip, there are a few other questions that need answering.

The size and capabilities of the board need to be considered, for instance. If you're aiming for a compact or low-power system (such as an HTPC or media server), then look for micro-ATX or mini-ITX boards. If you're aiming for a regular desktop PC, a normal ATX board is the standard choice. If you're aiming for power, get a board with robust overclocking features and plenty of support for cooling expansions.

The number of expansion slots is also worth taking into account. Smaller boards may only have a couple of slots, but that's fine if they're going in small systems. If you have plans for a multi-GPU setup, make sure there are plenty of PCIe slots. Some features, such as on-board wi-fi or USB 3.0, might negate the need for one of your expansion cards, so take that into account as well.



Most motherboard upgrades won't present any problems with RAM, though smaller boards may have fewer slots, so take that into account if you currently have a full complement. There are two circumstances under which you'll also be required to buy new RAM when you upgrade your motherboard, however: if your current system is old enough to use DDR2 or if your new system uses DDR4. If you're upgrading from a DDR3 board to another DDR3 board, simply pull out your old RAM and put it in the new board, and it'll work fine.

It's worth noting that in the same way that the ability to overclock isn't something featured on all CPUs, not every motherboard can do it either. If you're planning to overclock, check that the motherboard's chipset does actually support it. Some can't overclock at all, some will only allow a limited overclock on the RAM, and others – usually the most expensive chipsets – can fully overclock both the RAM and the CPU.

Price & Manufacturer

Like graphics cards, motherboards are designed by specific companies (AMD and Intel) and then manufactured by third parties. Again, this means that the price and feature set of individual boards can fluctuate wildly based on the whims of the company putting them together, so you can assume the specs and advice given in these pages refer to the reference designs and may vary slightly.

So motherboard pricing runs a reasonably wide gamut, from £30 for the cheapest varieties (typically smaller or older models with fewer capabilities) to as much as £300 for the most feature-packed and advanced boards. That leaves a lot of room to manoeuvre when you're looking for the right one.

If you buy an Intel-based board, then you're unlikely to find anything using the newest chipsets for under £70. If you want something more modern, we'd recommend spending somewhere in the region of £80-£120. Above that, you're buying specialist overclocking- and performance-focused hardware that casual users don't need, but which gamers will be dead set on procuring.

AMD motherboards start just as cheap as Intel's but top out much lower. You won't find an AMD motherboard more expensive than £200 no matter how hard you try. That makes the sweet spot for current generation purchases come in a little lower, so if you budget between £60-£90 for an AMD board, then you're sure to get something worth owning.

Once you've decided on a chipset and price range, you'll then have to decide which manufacturer to go for. In the long term, the difference between manufacturers is reasonably small, since they all manufacture hardware using the same chipset specifications anyway. If you're a casual user who doesn't poke around inside your BIOS or case very much, you can probably base your decision on price alone without anything to worry about.

“If you're planning to overclock, check that the motherboard's chipset does actually support it”

In particular, Intel's own-brand motherboards are highly recommended for buyers who want to get a good deal on the price but who aren't interested in flashy design elements or additional features. Pickier users may be interested to know that Asus boards are often considered to have the best balance between features and reliability, but it's still a slim gap between Asus and its close competitors Gigabyte and MSI, so don't worry if one of the latter manufacturers has a feature (or price) you prefer!

Current Chipsets

There are loads of chipsets on the market, and extensively explaining the capabilities of each would see us quickly running out of room. However, we can tell you what the latest generation of boards are, what they're used for and crucially how they relate to previous generation hardware so that you know how to find your preferred options.

Intel Chipsets

Intel's motherboard lines over the last few generations have come in six different chipsets. The letter prefix indicates the board's purpose, and the number following indicates the position in the line. Q and B-prefixed chipsets are mostly aimed at business use, while H and Z boards are aimed at consumers.

The Intel 100-series chipset is designed for use with Skylake CPUs. They were first released in Q3 2015 and crucially aren't backwards-compatible with earlier Intel chips, thanks to a revised

socket type – LGA1151. They've dropped PCI support completely, and while they're capable of supporting DDR4 RAM, many boards still use DDR3.

As ever, there are six different chipsets in the series, all of which are grouped together under the 'Sunrise Point' codename.

H110 will be the budget consumer chipset, with fewer PCIe lanes than the others – just six, all of which are PCIe 2.0. It will only have four SATA 6Gbps ports, no SATAe or PCIe M.2 support, up to four USB 3.0 ports and up to ten USB 2.0 ports. Previous H-series boards had a limited number of DIMM slots, no overclocking support, no SLI graphics support and no extra features like Intel Smart Response SSD caching, so expect a similar stripped-down approach when the H110 comes to market. Its previous generation equivalents are the Haswell H81 and the Ivy Bridge H71.

B150 motherboards are out now and break with Intel tradition by being aimed at gamers as well as business users. The B150 has eight PCIe 3.0 slots, six SATA 6Gbps ports, up to six USB 3.0 ports, up to 12 USB 2.0 ports and no PCIe m.2 support. They're largely aimed at budget users, and again don't support overclocking or SLI. The previous equivalents are (loosely) the Haswell B85 and the Ivy Bridge B75.

Q150 motherboards are aimed at business users and are due for release later this year. They'll be similar to B150 boards but will support two more PCIe lanes, two more USB 3.0 ports and two more USB 2.0 ports. Its Haswell equivalent is the Q85, and the Ivy Bridge equivalent was the Q75.

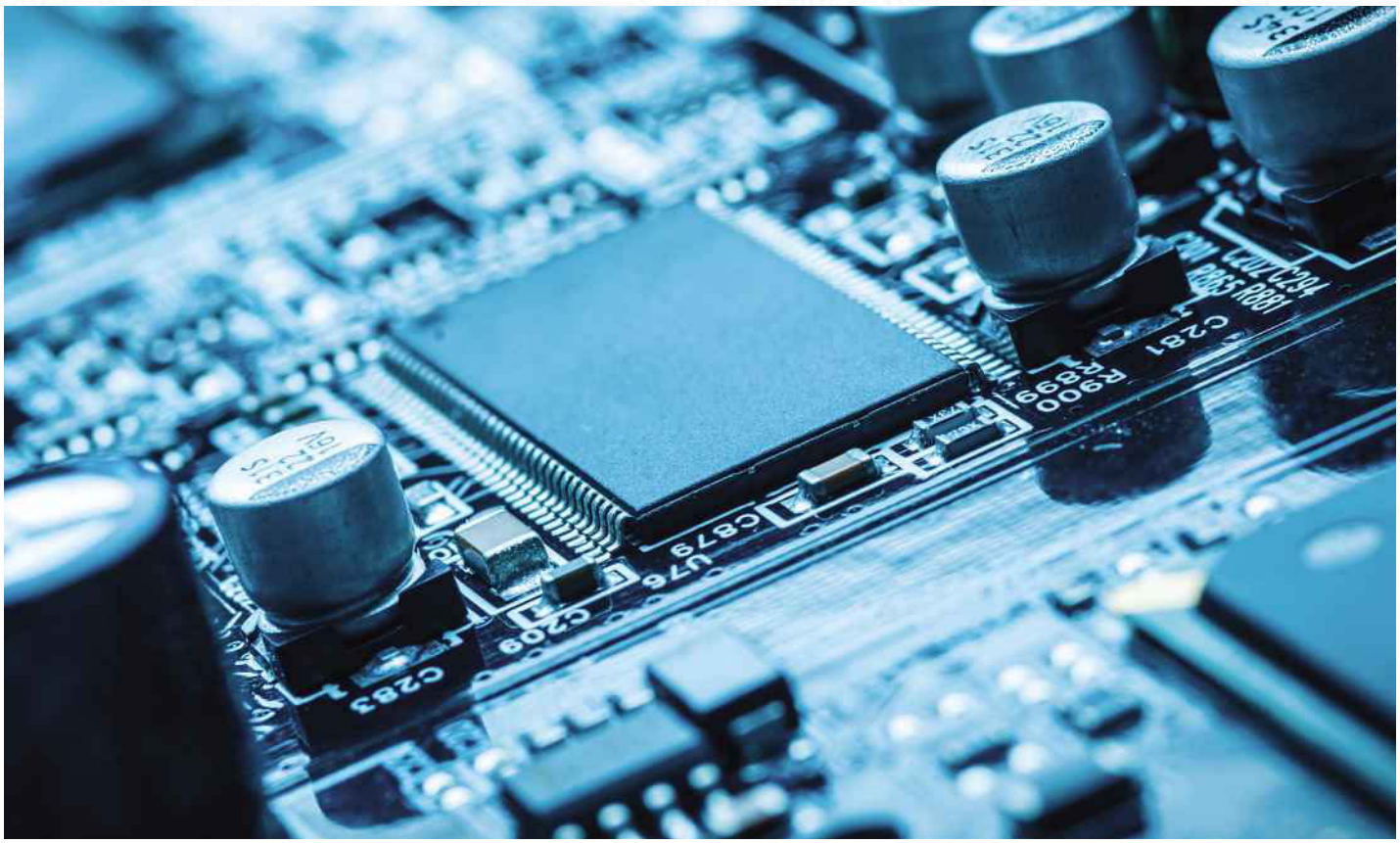
H170 boards are out now and aimed at mainstream PCs, replacing the Haswell H87, Devil's Canyon H97 and Ivy Bridge H77. They support 16 PCIe lanes, allowing for SLI mode graphics, six SATA 6Gbps ports, up to two SATAe ports, eight USB 3.0 ports, 14 USB 2.0 ports and two PCIe m.2 ports. Anyone building a standard home PC based on Skylake should start by looking at this line; the price is around £70-£100, making it quite reasonable.

"If you're buying a new motherboard, you could start by selecting one that's compatible with your existing CPU"

Z170 boards are out now and aimed at gamers and enthusiasts. The business-focused version, the Q170, will follow later this year with similar specs. These boards have 20 PCIe 3.0 lanes, six SATA 6Gbps ports, up to three SATAe ports, up to ten USB 3.0 ports and up to 14 USB 2.0 ports. They also support up to three PCIe M.2 devices. The Z170 succeeds the Devil's Canyon Z97, Haswell Z87 and Ivy Bridge Z77 with a complete set of features and full overclocking support. The Q170 doesn't support overclocking but has extra enterprise features. If you want a high-end system for business or pleasure, these are the boards to look out for.

AMD Chipsets

AMD's APU chips, which combine a CPU and GPU (like Intel Core chips), require a Socket FM2 or FM2+ depending on their generation. The current generation of Kaveri chips (including the Godavari refresh) use Socket FM2+, and their successor may also use this hardware. Socket FM2+ also accepts older Trinity and



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Richland chips, but not the first generation of APUs (Llano), which used Socket FM1.

The upshot of this is that if you're buying a new AMD motherboard, you're probably buying an FM2+ board. They have the most potential for upgrading and can accept at least one generation of older chips, and they may yet support the next version (AMD has announced it'll be around until 2016 at least).

There are four main lines for AMD's A-series chipsets, all of which can support Godavari features (though some may require a BIOS update to enable the newest capabilities).

The A58 motherboards are entry-level FM2+ boards, recommended for use with A4 and A6 APUs. They support dual-graphics (meaning an APU and compatible graphics card). Technically, the A58 has been replaced by the A68H, meaning A58 boards are very cheap. They're commonly cut down, with two DIMM slots, one PCIe 3.0 slot, one PCIe 2.0 slot and USB 2.0/SATA 3Gbps. Solidly last-generation stuff. They may suit budget system builders and those putting together compact systems, but at this point they're largely to be avoided outside of a specialist context.

A68H boards are a safer bet, aimed at home users with moderate needs. They're also designed to be paired with A4 and A6 APUs, with the same dual-graphics capability as the A58, but they also have native support for four SATA 6Gbps ports and two USB 3.0 ports.

A78 motherboards support PCIe 3.0, have a native six SATA 6Gbps ports and four USB 3.0 ports. They're designed to operate with A8 and A6 APUs, and they even support limited levels of overclocking, making them a good choice for casual gamers.

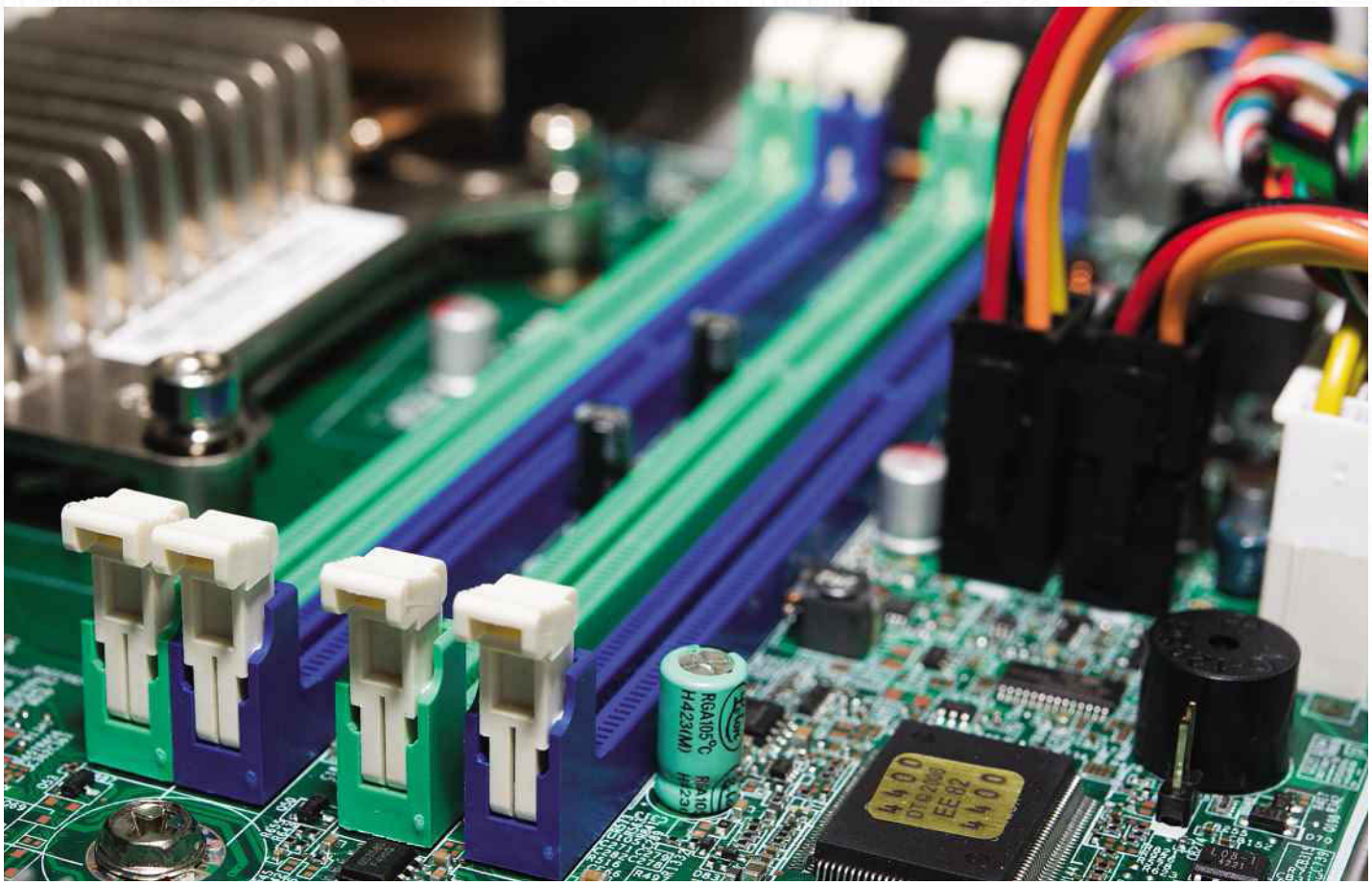
A88X boards are at the top of the heap, though. They support full CrossFire multi-GPU systems and full overclocking of the A10 and A8 chips they're designed to pair with. They also support advanced storage, like RAID, and have four USB 3.0 ports, ten USB 2.0 ports and six SATA 3Gbps ports.

If it looks like AMD's motherboards don't quite match up to Intel's, that's largely because they're older, though keep in mind that they are also cheaper even at the high end. AMD's next refresh isn't due for a good six months yet and maybe even longer – the company's plans are deliberately foggy, at this point.

If you are after an AMD motherboard, the A88X is the only one we can really recommend, mainly because it's the only one that comes close to Intel's offerings. But it's still quite far out of date by those standards, and when you're buying a new system or upgrading an existing one, it seems like a bad call to buy hardware this near to the end of its life cycle.

Ultimately, it's fair to say that buying the perfect motherboard isn't easy, but buying one that works is, so don't get too hung up on the specific differences between very similar models. As long as your hardware fits into it, you'll get by on basically any motherboard. But knowing enough to make an informed choice means you'll never have to pay for features you don't need or can't use. **mm**

> **“If you are after an AMD motherboard, the A88X is the only one we can really recommend”**



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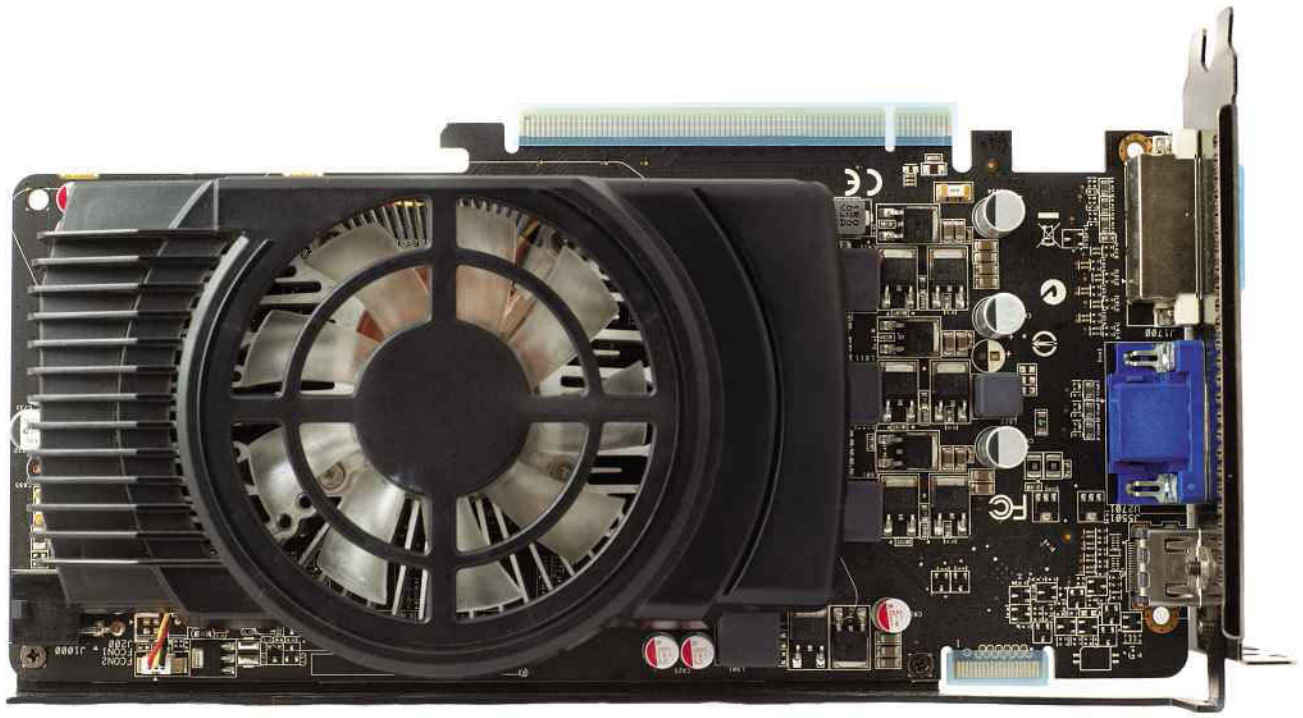
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GPU Buyer's Guide

Graphics card technology can be confusing, so let's break it down

The market for graphics cards is large and, in having two large companies dominate, similar to the CPU market in many ways. Buying a graphics card can be even more confusing, though, because of generational overlap (and the occasionally resurfacing) of technology; not to mention the fact that the capabilities of similarly named models can differ wildly. This has been even made worse by the fact that Radeon recently rebranded its entire line, meaning there are two different numbering systems for just one comapny.

For all those reasons, the best way to make sure you find the graphics card you want is to go right back to the basics and learn how to read the specifications for yourself. So, to make sure you can do that to the necessary extent, here are our explanations of graphics card specs and what you need to look for when you're trying to buy a new one.

Picking A Manufacturer

There are two major companies producing graphics chipsets – AMD and Nvidia. Both manufacturers has its own line of cards, each with their own advantages and disadvantages. As a consumer, the good news is that neither manufacturer is substantially better than the other in any universal way. The bad news is that this means you have to base your choices on lots of small differences instead, as with CPUs, on a couple of big ones.

As a general rule, Nvidia cards are slightly faster, but AMD cards are slightly cheaper, so you pay about the same amount for performance. At the very top end of the market, Nvidia cards are faster – but then there's over a thousand pounds of extra money separating the fastest AMD card – the Radeon R9 295X2 – and the fastest (and faster) Nvidia card, the GeForce GTX Titan Z. At the point where most consumers are going to look for cards, you could flip a coin to choose and not end up in any major problems. Functionally, performance will be indistinguishable from game-to-game.

If you're running an AMD-based system already, it's more likely that your motherboard and CPU will have features that can combine with AMD's Radeon graphics cards, and the same is true for Intel systems and Nvidia GeForce cards – but essentially, the two brands are equivalent to one another.

We'll get into the specific technicalities further on in this article, but for now we recommend that you start making your choice based on what the best card you can fit in your budget is. With graphics cards, you can usually squeeze out a fair chunk of extra performance by spending about £30 more, so establishing a point at which you will absolutely not pay any more is the best way to make choosing a card easier. Otherwise you'll end up with a £350 power-draining beast that is nonetheless technically better value than the £150 card you started looking at.

Once you've pinned down the maximum price you want to spend, you can start investigating the actual features of the card instead. Does it have the right ports you want? Does it have one or two fans? Is it double-height or not? Those factors are all more important to you, ultimately, than the manufacturer you choose.

It's also worth noting that the structure of the graphics card industry is a little unusual. Although AMD and Nvidia design and produce the GPU chips that power their cards, both companies sell those GPUs to other manufacturers, who produce their own versions of



the cards based on AMD and Nvidia's specs. The original design of the card is called a 'reference' version, but card manufacturers – such as Sapphire, XFX, MSI and the like – may add features not seen on the reference board. Extra ports, additional fans, and factory overclocks are just three things you might get from one manufacturer but not at another. So even after you've picked a card model, you may find yourself comparing two competing versions of the same product. In general, the differences between these cards is miniscule – we recommend you stick with a manufacturer you're familiar with unless you have good reason not to, just for peace of mind.

"We recommend you start making your choice based on what the best card you can fit in your budget is"

Graphics Card Hardware

To select a graphics card, you need to be aware of how the hardware relates to its performance – and there are many factors affecting this.

Chipset

The graphics card's chipset refers to the reference design it is based on. All cards with the same chipset have broadly similar capabilities and can be directly compared with one another in ways that other cards can't. If they have the same chipset they run on the same architecture, so it's comparatively easy to figure out when one of the cards is better – it's just the one with higher numbers!

If nothing else, it's worth paying attention to the chipset's process design, which is given in 'nm' (nanometres). As with CPU architecture, the smaller this value, the more energy efficient it is, and the faster the GPU can run.

GPU

A graphics processing unit (or GPU) is the processor of your graphics card, and the bit that performs the rendering and calculations for graphics. Most cards quote two speeds: the Base clock speed (which the card normally runs at) and the Boost clock speed (which it temporarily switches to at times of high load). These values are given in MHz, similar to normal CPUs, and dictate the number of updates that the GPU can make per second.

The confusing thing about clock speeds is that they can't be directly compared to check performance unless the chipset of the cards is the same. A card with an 800MHz clock speed can be faster than a card with an 1100MHz clock speed if the architecture is sufficiently different!

If the chipset is the same, you can use clock speed to compare card performance to an extent, however. Cards with a higher clock speed perform more operations per second, so it's not uncommon for manufacturers to perform a 'factory overclock' and run it slightly faster than the reference design – particularly if they add extra cooling to increase the hardware's temperature tolerance.

Memory

Memory is also important in determining speed. It's something of a misconception that extra graphics RAM will markedly improve performance – having the minimum amount of necessary RAM available is important, but if you have more than that amount it won't have any real effect – so don't go for 8GB unless you have good reason. More important is the type of RAM. GDDR5 is faster than DDR3, but also a more expensive.

Bandwidth

This determines the amount of data that can be shifted in a single memory cycle, and is affected by two factors: the memory clock rate and the memory bus size. Unlike GPU clock speeds, you can compare them across different cards as long as the RAM type is the same. The memory bus size is given in bits, and more bits means better performance. Most modern cards are likely to use at least a 128-bit memory bus, but you may see as high as 512-bit, with performance directly proportional to size. As a rule of thumb, you can quickly compare available memory bandwidth by multiplying the bandwidth by the clock speed. The bigger the amount that comes out, the better.

Standards Support

As well as the hardware capabilities, graphics cards listings will show the technologies they support, some virtual, some physical. Knowing what they mean will help you decide how relevant they are to you. For example, all cards will quote, somewhere, which version of the two main graphics APIs they support. The latest version of DirectX is 12 and the latest version of OpenGL is 4.5, though graphics cards still only support OpenGL 4.4 as standard. Don't worry too much if the card you're looking at only supports a slightly older version. Most of the time this won't result in any notable performance decrease, it'll simply block off access to some of the latest effects and shaders, but it'll take years to go entirely out of date.

Support for multi-card operation – called SLI by Nvidia and CrossFire by AMD – is only of any importance if you plan to run multiple cards in tandem. To run cards like this, the GPU needs to be the same (or have very similar underlying technology) which means that most SLI/CrossFire users buy two cards together. Some low-end cards explicitly will not support SLI and Crossfire, but in general, any card and motherboard at the mid-to-high end of gaming will.

The number and type of hardware interfaces is also worth paying attention to. Here's what you might find on a modern card:



Dual-Link DVI-I / DVI-D refers to a DVI interface with extra pins that allow it to reach resolutions of 2560 x 1600, instead of the single-link maximum of 1920 x 1200. DVI-I is a combined analogue/digital port, while DVI-D is digital-only. Your card may have both, or just one.

HDMI is a high-definition audio/video interface available in several different versions. The most recent pair – HDMI 1.4 and 2.0 – both support 4K video and 3D video, but HDMI 2.0 is the only to support 4K in 3D. HDMI 1.4 also only supports 24Hz refresh rate for 4K and 3D video, whereas HDMI 2.0 supports the full 60Hz.

Display Port is a video interface designed to replace VGA and DVI. With adaptors it's backwards-compatible with both ports, and can also be used to carry other data such as audio and USB signals.

Usually, it's possible to utilise several of these ports at once – sometimes up to four, depending on how many there are – so check the maximum number of supported screens. Note that some chipsets support more screens than the card can physically accommodate!

Current Models

Selecting the best chipset to look for within your budget means you've always got at least two decent options – one Nvidia and one AMD. It's also important to be sure you're actually getting a substantial upgrade from any integrated technology. So with that in mind, here are the best chipsets at common ps, and how they compare to one another.

Budget Cards: Under £80

The GeForce 700-series may have been succeeded by the 900-series, but if you're looking for a gaming-capable budget buy then the GeForce GT 740 remains your best choice. Specifically, we liked the look of the Gigabyte GT 740, with its 1072MHz clock speed, 1GB of GDDR5 RAM, max resolution of 4096 x 2160 and Gigabyte WindForce cooling system. Interfaces include dual-DVI, VGA and HDMI.

The only sticking point is that it's noticeably slower than the AMD equivalent, the R7 250X. It does have a

"Selecting the best chipset to look for within your budget means you've always got at least two decent options"

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significantly lower TDP (65 watts) making it excellent for low-power systems, but in almost every other way (including price) an R7 250X is better.

In terms of the Radeon's previous numbering system, the R7 250X falls somewhere around a GDDR5 HD 7750 (which it's a little faster than) – but 7000-series cards are largely off the market now.

Casual Gaming Cards: Under £140

The best Nvidia cards at this price are the GeForce GTX 950, which you can find with 2GB of GDDR4 memory. The best Radeon cards are the R7 370, which also have 2GB of GDDR5. The Nvidia cards are actually a little cheaper (but only by around £10), but this makes their general performance superiority much better to take.

Released this August, the GTX 950 is a cut-down GTX 960, and offers almost as good performance at a much lower price. It uses less power than its AMD equivalents despite performing much better, and it's capable of running even new games in full HD. For this type of use, the R7 370 just about loses out, and when you're looking at gaming that's enough to turn us off.

> **"The GTX 950 is a cut-down GTX 960, and offers almost as good performance at a much lower price"**

Mid-range Cards: Under £200

Again, Nvidia are the clear winner at this price with the Geforce GTX 960, the 4GB GDDR5 versions of which top out in the mid-£190s. AMD, by comparison, offers either the R9 380 – which is more like £170, or the R9 390 which is priced around £270. If you could still get the R9 280X, Nvidia might have had a fight on its hands, but it's disappearing from shelves fast. Besides which, the GTX 960 is still less power-hungry, cooler and quieter.

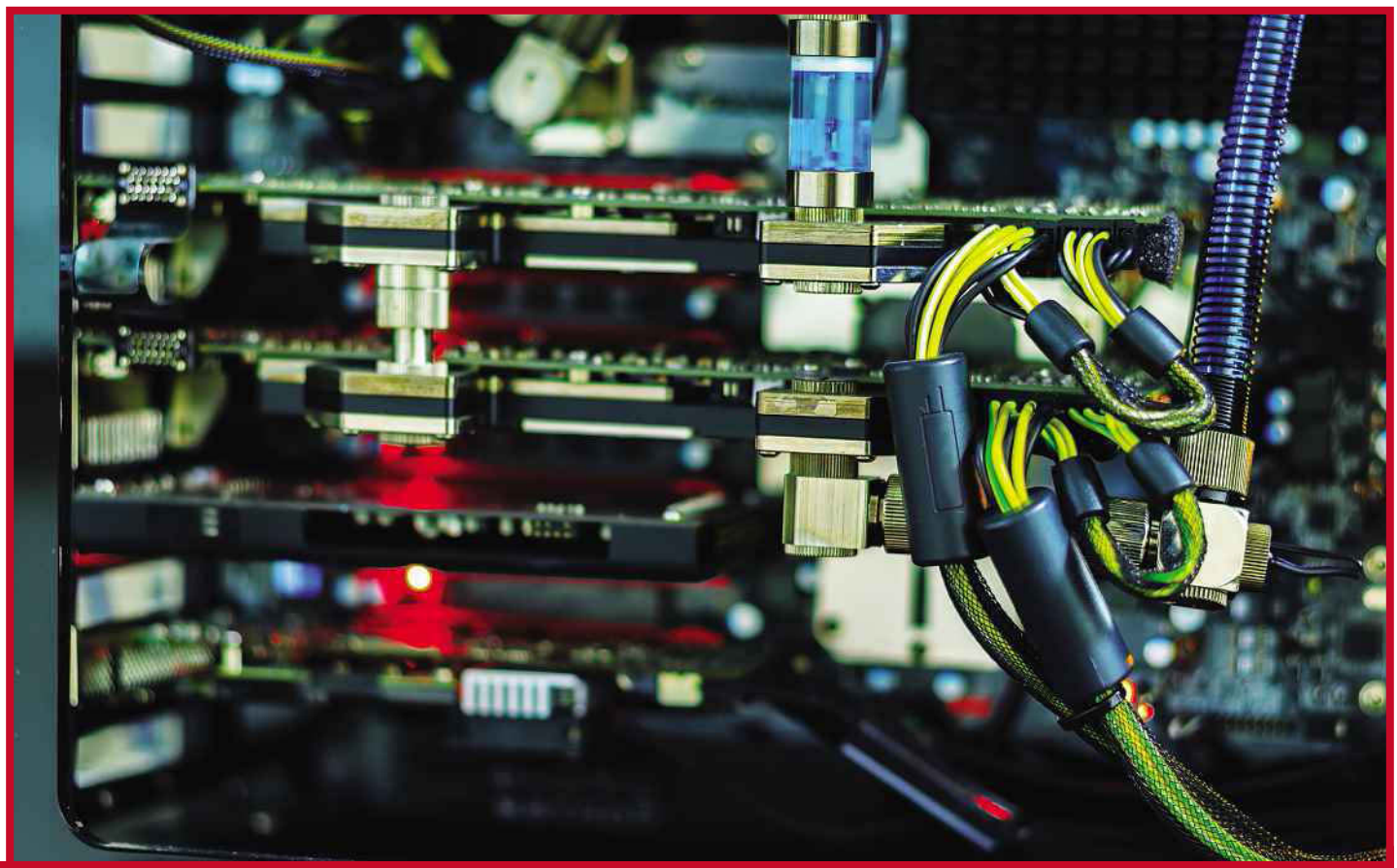
Despite similar model numbers the R9 380 is about 10% less powerful than the R9 280X in just about every way, which means it can't compete with the GTX 960.

High-end Cards: Under £300

Finally, Nvidia has a proper fight on its hands. At this end of the market, the Geforce GTX 970 is Nvidia's best card, priced at £280. The Radeon R9 390 is priced bang on £300, but the performance is proportionally better and it has double the memory. If raw performance matters most to you, the Radeon card is worth every penny. But other factors may sway you on the GeForce.

For example, it's a much less power-hungry card, and it runs much quieter as a result. If you aren't doing 4K gaming you don't need the extra capacity, and might prefer the £20. The Radeon is effectively future-proof, though, and unless you really need that £20 (in which case, we humbly suggest a £300 graphics card isn't in your best interests) then the Radeon ultimately wins out.

Unfortunately, the number of different models of card available make it difficult to be more specific that this, not least because availability varies wildly – but hopefully knowing what chipsets to look for can help you start figuring out which specific card fits your needs. **mm**



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The Best Value Components

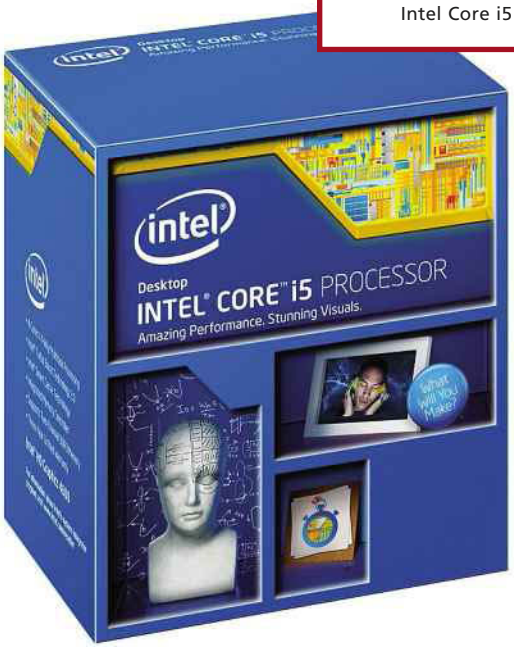
There's buying the best, and then there's getting the best value...

When you're trying to build a system, finding the best bargains can take a lot of research. You have to compare price and performance, as well as consider the economy of what you need now against what will be cheaper to buy in the future.

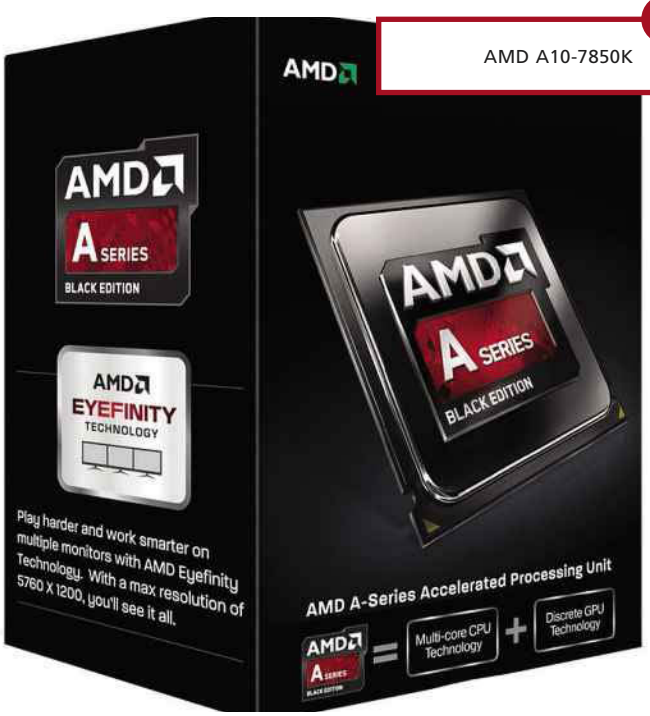
When the time finally comes to make a decision and lay down your hard-earned cash, it can be tempting to go for the most recent, the most expensive or the most prestigious components in order to give yourself the best chance of getting ahead. But really, all that gets your is a system that costs more than it's worth. If you want to get the best value components, you have to look up and down the entire spectrum of available models, and not be afraid to buy hardware that's slightly older to stretch your money as far as possible.

Hardware that isn't brand new – but which is, instead, towards the middle of its life-cycle – is often heavily discounted. However, it often retains competitive performance; so it's possible to save a lot of money and get a system that's still above average simply by being canny about what you select. And that's what we're going to help you do.

Of course, this reasoning doesn't apply to every type of product. Sometimes the best value products genuinely are the newest, or the most expensive. So to help you find the best bargains for your system, we've combed the market and compiled the information to help you make every penny you spend go as far as possible..



Intel Core i5 4690K



AMD A10-7850K

Best Value Intel CPU:
Intel Core i5 4690K (£180)

Although it's a previous-generation Haswell chip, the fact that Skylake CPUs are still priced as a premium makes this a much better choice if you're looking for good value. It's part of the Devil's Canyon refresh, so it's still quite current, and performance-wise there's a only a sliver of difference between it and the Skylake equivalent, the i5 6600K.

To talk actual numbers, the performance gap between the 4690K and the faster, costlier 6600K is about 1% in real terms, which compares pretty favourably to the 10% difference in the price. Most of Skylake's improvement at this end of the market are around the matter of power consumption and heat output (thanks to 14nm fabrication) and that's not much use if you're more concerned with a bargain.

As a chip in its own right, it's pretty good too. It's unlocked, so you can push it well beyond its stated means if you're up for

taking a risk in order to reap the rewards that overclocking offers, and its status as a high-end Core i5 makes it a naturally good all-round performer.

Core i3s don't stay competitive for gaming as long as most people would like and, while Core i7s mostly improve multi-threading capabilities that aren't much use for general day-to-day computing, and are only peripherally useful for gaming too. That means, that the message is clear: if you want the best balance between price and performance, the Core i5 4690K is the chip to get. At least, that is, until Skylake's prices start dropping – which may not be for a while yet. So, unless you're prepared to wait for that, you should be going for this.

Asus Z97-K



Gigabyte GA-F2A88XM-D3H



Best Value AMD CPU:
A10-7850K (£100)

It's the best chip in the AMD A-series line, but recent price drops mean you can actually find it for under £100 if you shop around, and that makes it a fantastic deal by any standard. The quad-core, multiplier-unlocked 3.7GHz A10-7850K costs about half as much as Intel's top-end Haswell Core chips, which partly illustrates the scale by which AMD and Intel's performance differ, and partly makes this a great deal.

In processing terms it's competing with low-end Haswell chips like the Core i3-4350, but that chip is about £15 more expensive and crucially, doesn't have AMD's superior onboard GPU. Because what makes Kaveri chips attractive isn't their single-threaded performance, but the graphical capabilities that allow you to save money on buying a graphics card. This chip packs in an R7 GPU, which is outright superb compared to Intel's HD Graphics 4600.

The A10 7850K is unlocked, so there's a little more performance to find within it, but we'd stick with it for budget gaming systems and not worry too much about performance tweaks. AMD chips might be hard to recommend in many cases, but good value is one area where they undeniably trounce Intel.

"If you want the best balance between price and performance, the Core i5 4690K is the chip to get"

Best Intel Motherboard:
Asus Z97-K (£94)

As with CPUs, the best value motherboards are found in the Haswell generation of chips, and in this case it's also Devil's Canyon board we like the look of. Given the price spectrum of motherboards, we can't recommend one that costs more than £100, but at the same time if you want maximum value out of your processor you need to get one with overclocking capabilities.

Which leads us, ultimately, to the Asus' Z97-K board. It doesn't showcase all of Z97 chipset's features (it's not SLI compatible because the secondary PCI-E slot is only 4x speed) but that's a feature that the majority of PC users will never use anyway. Unlike cheaper Z97 boards, this one has four RAM slots, and that's a feature which, by contrast, is worth paying for in case you ever want to add more memory without replacing your existing set.

There's also no wi-fi, but when you can buy a wireless card for £20 or less, it's not worth worrying about – it's almost always more expensive to get a motherboard with onboard wi-fi than it is to buy separately. There are definitely cheaper Intel motherboards around, but this one gives you by far the best options for the future.

Best AMD Motherboard:
Gigabyte GA-F2A88XM-D3H (£57)

If you're buying an FM2+ chip, you need a relatively solid motherboard to go with it, and you won't get the power most systems need out of anything that isn't an A88X chipset. Although high-end gaming versions push £100, we've gone for one that's almost half the price on the basis that extras like wi-fi can be



procured elsewhere, and no-one needs enough space for CrossFireX support if they're using an AMD chip with onboard GPU.

As such, it's the Gigabyte GA-F2A88XM-D3H that we recommend. It's got four DDR3 slots, support for all major graphics outputs, Gigabit Ethernet built-in, a PCI-E (x16) slot, a PCI-E (x1) slot and an additional PCI (x1) slot. As well as eight SATA 8GB connectors, RAID support and four USB 3.0 ports.

It is possible to find cheaper boards with similar features, but between Gigabyte's reliable name and a full complement of RAM slots, we wouldn't advise going any cheaper than this board. We'd actually prefer more PCI-E slots, all things considered, but the trade-off between price and flexibility isn't quite worth it when you take into account the type of systems that are going to be running AMD chips. That's the problem with buying for value rather than performance – there's always some trade off.

Best Value SSD:
Crucial MX200 500GB (£130)

Crucial's MX100 SSD drive was a low-priced mainstream SSD aimed at general users, and it did very well for itself by all accounts. Its successor, the MX200, is doing even better. While the only notable change between the two models is that the MX200 features a new type of SLC caching called "Dynamic Write Acceleration", both drives are based on a Marvell 88SS9189 controller with 16nm NAND and eDrive encryption.

Of the three capacities available – 250GB, 500GB and 1TB, it's the middle one that offers up the best price to performance ratio. When it comes to a simple price per gigabyte calculation, the 1TB version is just about a better price – you get 3.9GB per pound, whereas the 500GB gets you 3.8GB per pound and the 250GB just 3.5GB per pound – but the speeds (and lower outlay) of the 500GB model means we favour it over the 1TB version. £258 is simply too much to spend on storage.

"Western Digital, Toshiba and HGST offer quality drives, but Seagate are the cheapest"

And even if the larger drive is technically good value, the rapidly dropping price of SSD makes it something of a false economy. Buy the smaller drive now and by the time it's full, another 500GB will cost considerably less than the extra you'd pay to buy a 1TB drive today.

Best Value Hard Drive:
Seagate 2TB (£54)

When it comes to hard drives, you don't have to worry about reliability and speed much these days unless you're building a specialist NAS system or similar. Most hard drives will last long enough that general-use consumers will replace them before they break, and even the fastest drives can't compete with SSDs. So that means it's back to the good old days of caring about capacity more than anything else.

In this case, the trick is to find the capacity that's currently cheaper than the others. Right now, that's 2TB. Most of the price of 500GB and 1TB drives is the manufacturing cost of the drive itself (which is why they're both between £30 and £40) whereas 3TB drives are still at a slight premium. By comparison, 2TB drives (at least, standard varieties) normally cost less per gigabyte than larger and smaller capacities do.

That's certainly the cast for Seagate, whose £54 2TB drive is better value than their £38 1TB drive and £70 3TB drive. To be honest, it could be any manufacturer at this point: Western Digital, Toshiba and HGST offer quality drives with no major reasons to avoid them, but Seagate are the cheapest That also makes them the best value as far as we're concerned, because as long as it stores your data intact, what else do you want from a mechanical hard drive?

Crucial MX200 500GB



Seagate 2TB



Best Value Nvidia Graphics Card:
Asus GTX 750 Ti OC Edition (£100)

We work under a general assumption that a 'good-value' GPU has to come in under £150, Nvidia has a slight advantage when it comes to budget buying, because their cards are all cheaper than AMD's. The best GTX 750 Ti we could find was Asus' factory-overclocked card, and you can pick that up for as little as £100. Not an insignificant saving to make, all things considered.

The Asus GTX 750 Ti OC edition has 2GB of GDDR5, a clock speed of 1072 MHz (against the reference design of 1020 MHz), a max resolution of 2560 x 1600 and interfaces include D-sub, dual DVI and HDMI. Its TDP is a frankly meagre 60 watts, which puts it in a completely different class to the AMD cards it's priced against. Crucially, it's the fastest card on the market which doesn't require an external power supply, which means that you can convincingly upgrade virtually any system regardless of how low-end it is.

That does mean this card is good if you want to put it in a budget or specialist system – there's no danger it'll need a new PSU to power it, and you won't end up with a system that sounds like a jet turbine readying for lift-off. If raw performance is your goal rather than value, then we suggest looking at some of the GTX 950s on offer instead.

Asus GTX 750 Ti OC Edition



Best Value AMD Graphics Card:
Sapphire R7 370 DUAL-X OC 2GB (£130)

If you want a new card, then the R7 370 is surprisingly good value. That's because despite being released in June, it's actually more got internals that look more like its Radeon 7850 HD heritage. It's based on the Trinidad chipset (formerly known as Pitcairn) and clocked at 1GHz, above the reference design of 925MHz. The 2GB version is better value than the 4GB version (there's barely any noticeable difference in performance unless you're trying to play at UltraHD, which the card's GPU can't really cope with anyway).

The R7 370 is much faster than the GTX 750 Ti, which in part accounts for the latter's price drop. But It has a high TDP (140W in tests) which is much higher than the GTX 750's requirements. It's a solid piece of gaming hardware that should remain competitive for some years to come, but we don't want to suggest that it's a particularly good card – only if you're working with a very limited budget. The Dual-X cooler definitely seems impressive compared to other cards at this price point, but again, you may be able to get away with some slightly cheaper models.

We like Sapphire's cards generally, though, and the overclock means they have the slight edge over cheaper cards. Just don't be fooled by the 4GB version, which presents no immediate difference in the vast majority of titles. **mm**

Sapphire R7 370 DUAL-X OC 2GB



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How **Gamification** Is Changing The World

It's a word that pops up a lot, but what does it actually mean? And how exactly is it used? Rob Leane investigates gamification...

You might have heard the term 'gamification' bandied about a fair bit in recent years, especially if you work in the realm of technology. It might one day be a household term, but for the time being you could be forgiven for not quite understanding what it means or what the point of gamification is.

It's changing the world in some interesting ways, though, so now's the time to learn more.

The basic concept is simple – adding gaming elements to mundane tasks to make them more interesting. These can include scoring points, setting targets and entering competitions with others. By making things a bit more like videogames, they can become more engaging and appealing.

British programmer and inventor Nick Pelling coined the term gamification in 2002, and the prevalence of gamification really took off in 2010. However, the idea of adding gaming elements to various sorts of project predates the actual term by some distance. Charles Coonradt, who found the consultancy firm The Game Of Work in 1973, was retroactively dubbed "the grandfather of gamification" by Forbes Magazine, in 2012.

The concept of gamification has developed over the years and has been used in various fields. At the moment, it's changing the way we think about healthcare, fitness and education to name just three. To get you fully clued up, then, here's our run-down of some of gamification's most world-changing implementations…

Business

Countless companies have used gamification to liven up their working processes. So much so that companies like Bunchball, Badgeville, PlayGen and InsideSales.com have cropped up to offer creative gamification solutions to businesses and other clients.

If you're in charge of recruitment for an exciting workplace, gamification can help you show off exactly what you're offering. A



Virtual army experience



prime example of this is the American military, who began developing their first "virtual army experience" as far back as 1999. By 2008, they had four transportable games units touring shopping centres and public events. Members of the public could come and test their military potential in a virtual environment, making the recruitment drive much more interactive and interesting.

Rewarding customer loyalty is another popular way to integrate gamification into business. Mobile phone manufacturer Samsung was an early adopter of this method, bringing in a game-style system, where customers are rewarded for reviewing products, watching videos or engaging in online forum discussions. Levels of achievement and a series of winnable badges are among the prizes.

Gamification can be used to engage with potential employees and keep customers happy, then. It can also be used to motivate your workplace team and discourage slacking – such is the goal of Keas, a website best described as an 'employee wellness platform.' On Keas, companies and their employees get access to statistics about their performance, can comment to encourage their peers towards targets, and are rewarded for getting jobs done.

Proof – from Mindbloom – has a similar remit to Keas, allowing users to set seven-day challenges for themselves and then provide video evidence to 'prove' when they've completed them. Progress can be tracked via smartphone, and adding in targets can provide an extra level of motivation. The 8-bit gaming-style graphics are a nice touch too.

Education

Before you even have a job, gamification can help. For example, online coding academy Treehouse offers points and badges as rewards for completed training tasks, and it keeps a log of all your achievements to showcase your skills to potential employers.

Kaplan University (which offers courses online and in several American cities) also utilises gamification, via Badgeville, using targets and badges in order to encourage engaged participation in its curriculum. Apparently, it saw higher grades and reduced rates of students failing to complete their courses after introduce the online scheme.

Learning languages has also been tackled by gamification. Duolingo is a crowd-sourced collaborative community website where students are progressed through various levels of translation tasks. As they spend more time on the website, they'll gradually be given harder and harder assignments. Students can also vote on the quality of their peers' translations, adding an edge of competitiveness to proceedings.

Microsoft has also dabbled in educational gamification usage. For Office 2007 and 2010, the company offered a free-to-download to game, Ribbon Hero, to help explain Word, Excel and PowerPoint. The game's various levels (including a memorable Ancient Egypt stage) are all addictive and fun, as well as offering a greater understanding of the programs that it's embedded within.

Gamification doesn't just assist adult learning, either; it's also been implemented in school classrooms. ClassDojo is a notable example, acting as a classroom management system, where each pupil gets a virtual avatar. These can easily be displayed to children to give quick 'feedback points', reinforcing good behaviour and encouraging kids to compete to earn the most points.

Big topics can be explained to school pupils through gamification too. The World Peace game, created by education expert John Hunter, is one such example. It's not digital, but a highly competitive board game. In The World Peace Game, children must try to broker peace in a world consisting of five countries. Social, economic and environmental issues come into play, and the class must find a way to set things right.

In the online realm, there's Evoke, which serves a similar purpose in a slightly more modern way. Produced by The World Bank, Evoke



Ribbon Hero 2



The World Peace Game



Play To Cure: Genes In Space

encourages young people to tackle issues like hunger and poverty, using a series of targets and rewards to keep young people in the game. The World Bank also offered seed funding, mentorship and scholarships to the original winners (those who fared best in the year of Evoke's launch, 2010).

Physical Health

The world of medicine has also benefited from the integration of gaming features. Once such example comes from the developer Ayogo, which created the app Empower.

Designed specifically for patients with chronic conditions, Empower aims to help these people improve their health and stay active.

Daily, Empower will suggest games, surveys and small activities as a way of tracking each user's behaviour. The aim of the game is make these physical and mental activities a habit rather than a chore.

The app Reflexion Health is all about physical therapy. It aims to try to make habilitation exercises more fun, because otherwise patients might not complete the activities in their own time.

Reflexion offers a virtual platform, where an animated instructor will guide them through their exercises every day, with feedback offered to users via motion sensors and full statistics sent to their physicians for further analysis.

Gamification doesn't just help those already affected by injury or illness; it's also being used to try to tackle disease itself. Cancer Research UK has developed Play To Cure: Genes In Space, the world's first free mobile game to utilise its players as a way to analyse real genetic data.

Play To Cure visualises medical data as a science fiction shoot-'em-up game. While playing, you must pilot your spaceship and collect the scattered parts of 'Element Alpha,' the in-game visualisation of the cancer cells.

This saves the Cancer Research UK researchers hours of time, because you're picking out the cells on their behalf and finding the quickest route to get to them. Over time, this could be invaluable work. And you're doing it by playing a game.

Puzzle game FoldIt served a similar function to AIDS researchers in 2009; players of FoldIt found a solution regarding the structure of the M-PMV virus in just ten days. Fantastic, isn't it?

Mental Health

Gamification is also changing the landscape of mental health research. Dr Tracy A Dennis created the app Personal Zen as a way to reduce anxiety and stress, which puts well-established strategies to tackle these issues into the palm of your hand.

Personal Zen – which offers a variety of games in several different environments – was named the third best health app of 2014 by CNN Health and has received several positive reviews from industry experts. The team behind the app are planning to develop apps that support those who suffer from depression and addiction.

Other apps have already tried to explore issues of depression. One of these is Depression Quest, which is all about increasing awareness.

Depression Quest attempts to reflect the experience of depression to its users, so they can better understand those who suffer from the condition. It uses pictures, static, questions and story to try to represent what depression is like. Not all the reviewers are positive, but it's certainly an idea that could help a lot of people.

SuperBetter is an app that attempts to offer the full package, aiming to help build up our core strengths of mental, physical, emotional and social wellbeing. The game asks you to set yourself big life challenges as well as smaller targets to help you along the way. These small achievements can help you stop the 'bad guys' of the game – those being your emotionally stressful experiences.





On a less drastic level, Lumosity aims to improve your "core brain abilities – and empower users to live better, brighter lives." Luminosity is reminiscent of Nintendo's Brain Training games for the DS, offering a series of mini-games to help strengthen your remembering capability and attention span.

There's a game in development that attempts to educate children about mental health too – the excellent MindLight from The PlayNice Institute. Turning on the lights is one of the aims of the game, as is overcoming your fears and saving your nan. You won't be able to play this one on your phone (it requires a headset), but it's a truly wonderful idea and a great example of how games can help make the world a better place.

Fitness

Fitness is an on-going struggle for a lot of us. There's hardly a shortage of fitness apps, though, and on a base level, they all sort-of represent gamification. Apps like Runkeeper (or Caledos Runner on the Windows Phone) help record your activities, encourage the setting of targets and allow you to compare your results with your peers' efforts. Those are all features that you get in videogames too. However, some fitness apps take the gaming connection to the next level.

One of these that particularly excites us here at Micro Mart is Run An Empire (still in the testing phase), which reimagines your local jogging community as a *Game Of Thrones*-style battle for regional power.

You can claim an area by running there before anywhere else. Others can steal it back from you if you don't run there for a while and they do. You can scout out cunning routes to get revenge. The app apparently rewards determination, not just your running speed, meaning professional athletes and the like won't be the only ones to control your local empires.

This isn't the first app to turn jogging into a game. There's also Zombies, Run!, which – as you might have guessed – turns your casual runs into an apocalyptic showdown against the undead. As you activate the app, it'll give you a mission. If you don't move quickly, you'll die (AKA failing the mission). There are bonuses available for collecting supplies, which can help you out of tight spots when need be. If you a) wish your life was more like *Zombieland* and b) would like to get in better shape, then Zombies, Run! is probably the app for you.

There's also a fitness app offering rewards in our so-called 'real' lives, combining the elements of gamification with tangible treats. If 'fantasy' empires and zombie uprisings don't get you off the sofa, perhaps you could try Runnit, which gives out vouchers, discounts and freebies as prizes for fitness targets that you reach.

Local Rejuvenation

Speaking of real life, there's been a push in recent years to rejuvenate cities and towns with interactive experiences. In 2009, Volkswagen sponsored a project to turn a Stockholm subway station staircase into a working piano.

This not only livened up a dull area, it also encouraged people to use the stairs rather than the elevator. Volkswagen also made a bin that makes funny sounds when you put your rubbish in it, adding a little excitement to the world and discouraging littering at the same time. These are just two small examples of how tech can be used to make the mundane parts of life exciting and do a little good.

In July 2015, British city Bristol played host to a new digital project dubbed Hello Lamp Post. The idea was to make the city playable, to install gamification anywhere possible and liven up the city a little, and connect people in an interesting new way.

The idea came from research and design studio PAN and specifically included residents communicating with everyday street furniture like lamp posts, post boxes and bus stops.

Prior to the event, these objects were coded up to give them identity numbers. Residents could text each object's ID number to 'wake it up', and then they could start a conversation with it. You would then have to answer a few questions – where you were, what you could see, and so on.

When the next person came along, they'd have a different conversation because of the answers the last person had given. As a result, little stories and opinions would filter from person to person, complete strangers connected by inanimate objects.

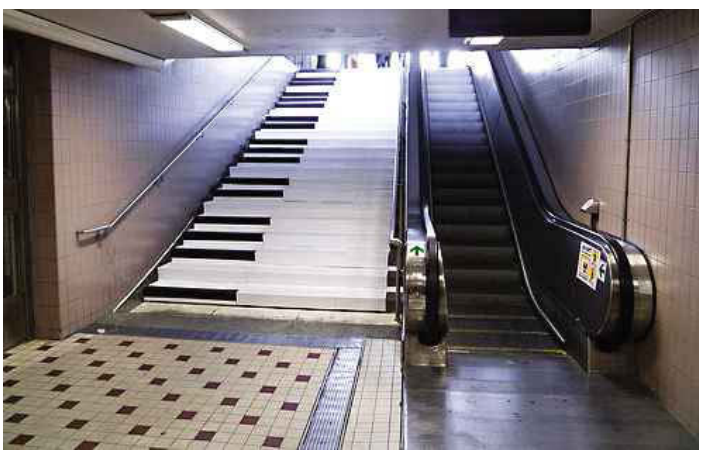
Compared to gamification apps and websites, the gamification of towns and cities is at a fairly early stage, then. However, given time, we could all be interacting with our local areas in new interesting ways on our phones, computers and in real life.

In Conclusion

Just to wrap things up, then: there are many ways that elements of gaming technology are being incorporated into other areas of our lives. Undoubtedly, gamification is changing the world.

Digitalised goals, targets and rewards have been brought into businesses, education and fitness, while games are also being built to help with our fitness and health on mental and physical levels. Going forward, gamification could be coming into our towns and cities too, with interactive features bringing mundane objects to life.

We imagine there'll be more and more advancements in this field in the coming years, and we'll be sure to keep you up to date as we hear about them. It's far from game over on this one. **mm**



The Dark Web
What Is It, And How Does It Work?

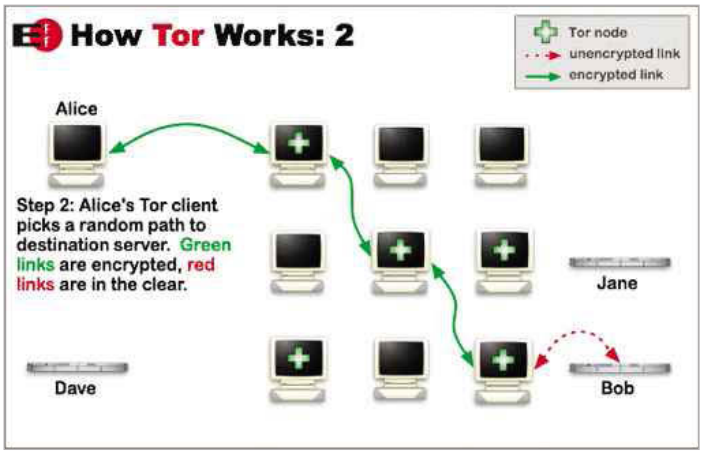
There's a seedy underbelly operating within the depths of the internet you use every day, but it's not easy to access and you probably won't want to

It doesn't matter how much of a technophobe you are and how hard you try to avoid computers, there's no escaping the internet. It's everywhere, about as pervasive as anything you can think of in pop culture and is inextricably intertwined into society. Every company has a website, every store has an online presence and a mammoth proportion of the populace has some form of social media presence. Not having this can turn you into a social pariah; that's just the way the world is these days.

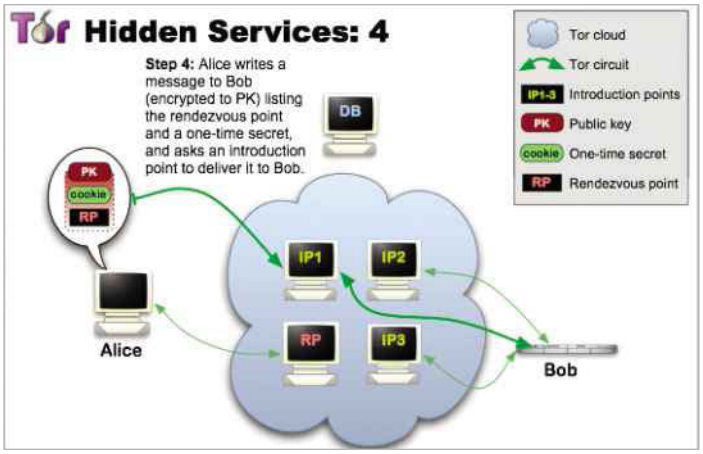
As accessible and widespread as the internet is, however, there's a far less open part of it hidden away. This is a darker, potentially unsafe area of the online world that isn't as simple to access and certainly isn't for everyone. This is called, rather suitably, the Dark Web or Dark Net, and it's a place that has a very questionable reputation, often for good reason. Before we elaborate on these reasons, we should look at what the Dark Web actually is.

Welcome To The Dark Side

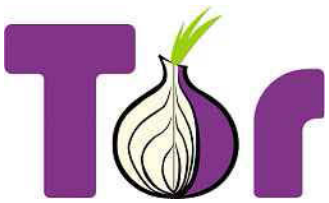
The Dark Web, not to be confused with Deep Web (see Deep And Dark) is a collection of websites, just like any others, the



How the Tor system works



Tor services and how they hang together



Tor – the Onion Router

difference being that you can't simply find these by mooching around on Google. Dark Web sites aren't indexed and categorised like normal sites and won't show up in standard search engines. Instead, these sites purposely hide themselves from easy location, and to actually visit them you need to use special means, including special software and browsers that can access them. With this software installed, the Dark Web is open to those who wish to browse its contents.

There's a host of different tools and applications that can be used to access the Dark Web, but we should provide a very important caveat before we go any further.

We don't advocate the use of the Dark Web including many of the services on offer. There's a reason the Dark Web is so secretive, and this includes just about the most morally bankrupt and downright illegal content you'll see, which we'll elaborate on later. It's not all like this, but it does exist, so be warned. Our aim here is to inform but not recommend, and if you do choose to explore the Dark Web, you do so at your own risk, both legally and with the obvious security concerns that come with using such questionable software and browsing such unsavoury sites. We won't provide links for the software we cover; you'll need to find and grab it yourself if you choose to proceed.

Now that's out of the way, what are some of the most common ways people access the Dark Web?

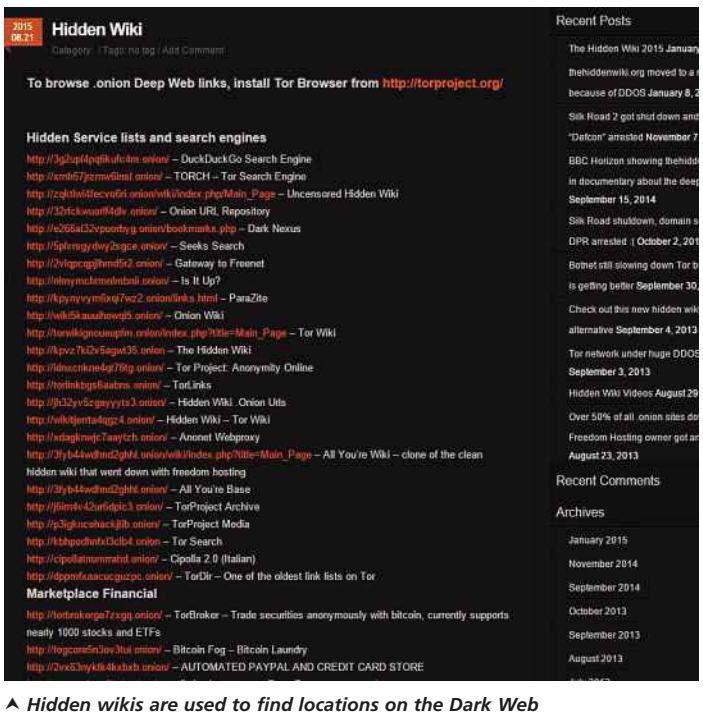
Perhaps the most common and popular method of accessing the Dark Web is Tor (The Onion Router). This is an anonymity tool and encryption protocol that advertises the ability to protect you online, hiding your identity and shielding you from network surveillance and traffic analysis. Basically, by using this, it's claimed you can do what you like online and no one will ever know about it. Tor is free, includes a browser (a modified version of Firefox) and is very easy to use. With it, people can get onto the Dark Web quickly. The software is actually legitimate and isn't solely designed for use with the Dark Web. It's advertised for use by family, businesses and media but is also promoted as a tool for activists and even the military and law enforcement. The latter is quite ironic, given the popular use for Tor is to access a lot of illegal services.

Tor isn't the only tool people use. Other packages include I2P (used by the new Silk Road Reloaded, which we'll talk about later) and Freenet, but the Tor network is pretty much central to the whole thing, and most sites on the Dark Web hide themselves using Tor encryption. The sites are publicly visible with the aforementioned software, but it's very difficult to actually see who's running them.

What's Tor For?

The Dark Web is used for many different purposes, some legitimate, but often it's a haven for illegal services and corrupt activity. The

> **With all this effort put into keeping things hidden and away from the mainstream, online world, the Dark Web has become a haven for many criminal activities**



Hidden wikis are used to find locations on the Dark Web



Virtual currency Bitcoin is very popular within the bowels of the Dark Web

Dark Web has been shown to offer many and varied services, including a whole host of hacking services, the likes of which we've seen a lot lately, with attacks on high-profile companies.

However, the Dark Web is also host to much darker and more worrying services. There are reported sites based on various illegal communities, such as paedophile groups and human trafficking, firearms sales, and there are even supposed to be sites where people can fund assassinations. It's grim, but with the internet being so prevalent in today's world, it's also not all that surprising. We all move with the times, and so do criminals and illegal enterprises.

A vast amount of the Dark Web revolves around drugs and drug sales. According to many reports, this is the overwhelming use for the Dark Web, followed by other activities, such as whistle blowing, financial attacks and fraud. Surprisingly, although it can be found, pornography and gambling activity is relatively low in content, although the material you do find will likely be very questionable, otherwise it would be on the normal internet.

The Dark Web is said to be used by a lot of groups to coordinate actions as well. This include activists, as we mentioned earlier, but also terrorist groups and cells. These groups make full use of the network's ability to hide both the service and those using it from prying eyes.

As we've said, not all of the Dark Web is illegal. There are plenty of blogs, communities and other sites that exist, some of which simply do so because they feel the Dark Web is the only way to ensure free speech and privacy from outside snooping, so contrary to popular belief, the Dark Web isn't solely a place for criminal activities.

Secrets And Lies

Another use for the Dark Web is whistle blowing, where people leak sensitive, often confidential information to the outside world, often to journalists. The Dark Web is used, because these informants are usually worried about revealing their identity. One of the most high-profile cases of this nature is Edward Snowden.

Snowden, who was a technical assistant for the CIA, leaked information about the NSA and its difficulty cracking emails and logs using specific encryption. This included the Tor network. He also disclosed top secret details of various intelligence and surveillance systems used by FVEY or 'Five Eyes'. This is the partnership between the US, UK, Canada, Australia and New Zealand. He's currently living in Russia where he's sought asylum, apparently looking for somewhere else to move to when his stay in Russia ends.

Hide And Seek

So if sites and services on the Dark Web are hidden and can't be found by normal means, how do you know what you're doing and where to go? Many users of the Dark Web use hidden wikis. Like any other wiki you'll find online, these are sites that operates as a guide and encyclopedia to the Dark Web, and they list the various sites and access methods for each.

Wikis are often broken up into various categories, such as drugs, erotic, hosting, blogs and so on, and they list the onion addresses for various sites, which can then be entered into your Tor browser. These can be found online right through Google.

I'd Buy That For A Bitcoin

A lot of business goes on in the Dark Web, both legitimate and illegal, and with such secrecy it's not surprising that people aren't exactly keen to part with their real names and/or bank details. Indeed, if you plan to use the Dark Web, it goes without saying that you shouldn't give out your real name and email address. With this in mind, a way was needed for people to pay for services and trade with others. Enter Bitcoin, the digital currency that's become hugely popular in some circles.

> **"Another use for the Dark Web is whistle blowing"**

Bitcoin, launched in 2009, is a digital payment system that trades virtual currency instead of real cash. This 'crypto-currency' is an decentralized payment system that doesn't need an intermediary to process payments, and it's perfect for use on the Dark Web, which is where it's used every day and has grown to become a huge currency for the Dark Web community. It's not only on the Dark Web where Bitcoin is used, of course. Many legitimate businesses use it, even high-street shops and cafés, but its use in criminal activity is very real, and law enforcement around the world is suitably concerned about it, and this includes its use online in the Dark Web.

Long Arm

With all this effort put into keeping things hidden and away from the mainstream, online world, the Dark Web has become a haven for many criminal activities. The encryption used and the ability for groups to communicate has made this an unavoidable fact, but users of the Dark Web aren't as safe as they think.

Just as hackers will always find security holes in any system, no matter how cutting-edge it may be, so too will law enforcement find ways to counter it. It's a never-ending war of



The Dark Web isn't out of reach of the law

Deep And Dark

The terms Deep and Dark Web are often used interchangeably, but this is actually incorrect, as the two are very different. The Deep Web is simply the layer of non-indexed sites that litter the internet. These are many and varied and are mostly totally legitimate but not used on the main, 'surface' web for numerous reasons, often for security. This includes research and academic sites, government sites and various databases. Nothing to worry about for the most part. The Deep Web is also used to store tons of legitimate information. Bank account details and other user data is often stored here, hidden from normal access.

The actual Dark Web is the selection of Tor network services that must be accessed through special means. This is where several unsavoury places exist, and is the place that tabloid media and other outlets often talk about, spreading a lot of fear, sometimes with the wrong name in the form of the Deep Web.

To use a classic, tried-and-tested analogy, think of the internet as an ice berg. The surface or tip that's above water is the internet we all know and use everyday. The larger, higher submerged section is the Deep Web and the bottom, deeper section that sees little to no light is the Dark Web. Most are perfectly happy to scratch around on the surface, but some are curious and want to dig deeper into that dark ice where it's harder for people too see what's going on.

Know Your Onions

An onion address, used by Tor, is a special type of web address that's different to a normal DNS address (Domain Name System). Onion addresses can't be found in the usual root of the internet's DNS system and so don't show up using normal software. The Onion TLD (Top Level Domain) can only be found using special software, such as the Tor browser bundle and proxy, and are accessed via the Tor network.

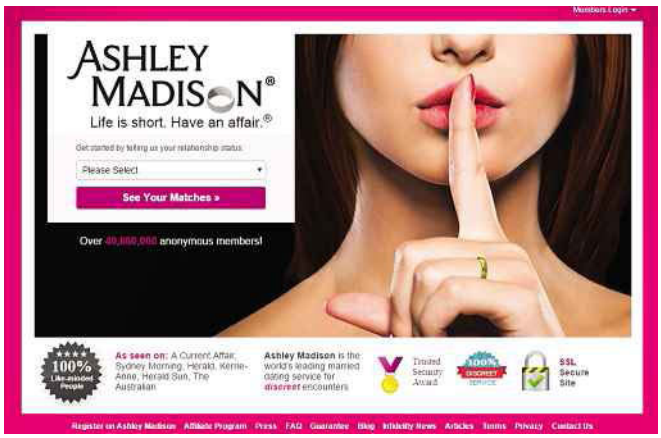
Ashley Madison

The website Ashley Madison has hit the news lately, and this story involves the Dark Web. For those unaware of the site, Ashley Madison is, to put it simply, a site that advertises itself to those who want to cheat on their significant others. Think of it as a dating site for people who want to play around. It's pretty grubby and reprehensible stuff, and a hacker group apparently agreed.

This group, which calls itself The Impact Team (including an individual hacker going by the name of aNewDomain), claimed to have stolen 10GB of user data from the site and threatened to release it into the public domain if the owner of Ashley Madison, Avid Life Media, didn't shut down the site. Avid Life refused to capitulate, and the group released the data onto the Dark Web.

The rest, as we now know, is history.

Sadly, sites like Ashley Madison exist, but a lot of people wish they didn't, including some hackers



> **Should you venture into the Dark Web? We'd have to say no, not really**

attrition, and the Dark Web is no different. Many arrests have been made involving users of the Dark Web, with some high-profile cases hitting the news. One case in particular involved Silk Road operator Ross Ulbricht.

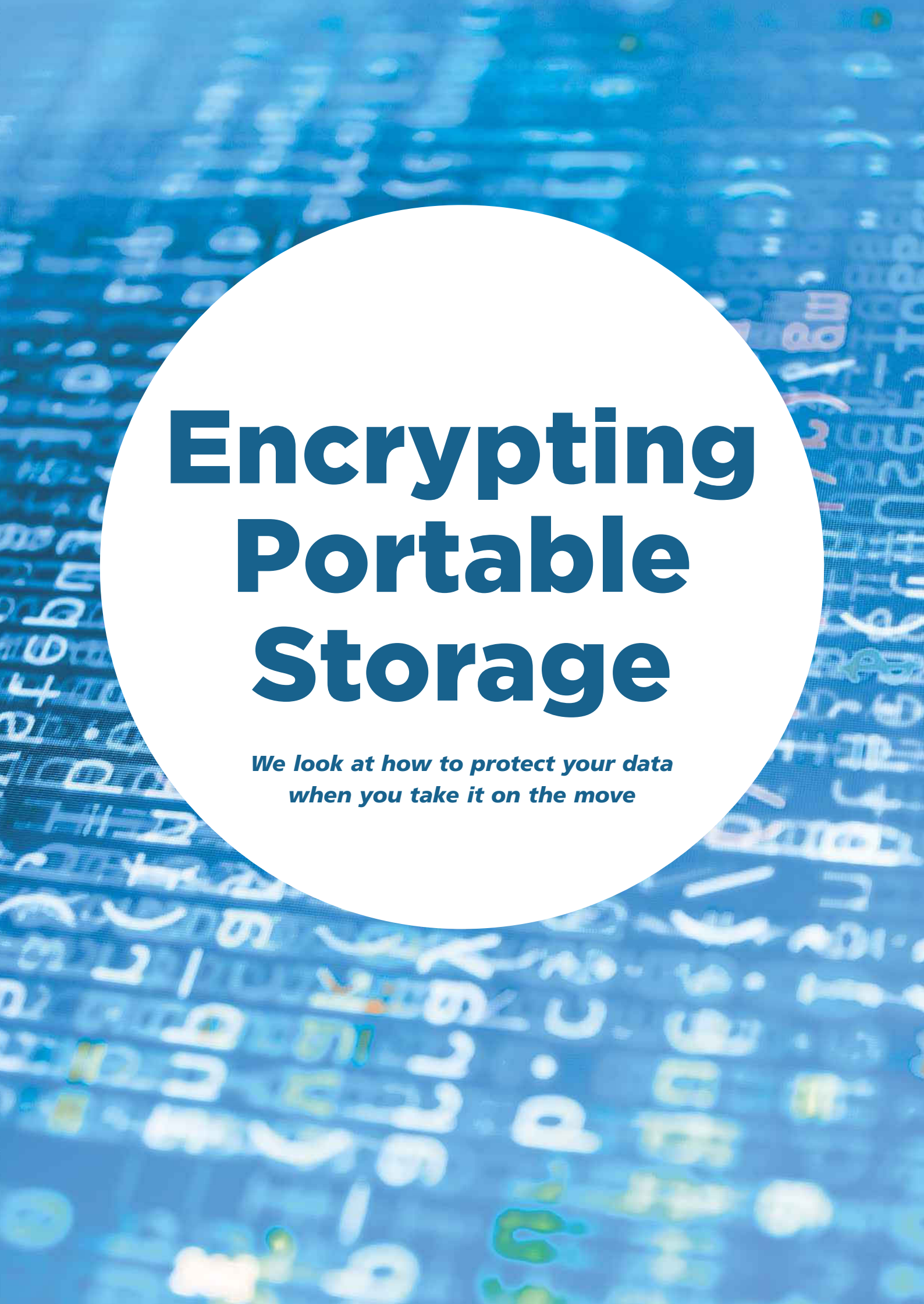
Ulbricht was the person behind the popular Silk Road drug service. This provided illegal drugs to customers via the Dark Web, allowing people to buy substances anonymously. After an investigation, the FBI eventually shut down the site in 2013, and Ulbricht was sentenced to life in prison. He was charged with drug trafficking, money laundering, hacking and even conspiring to murder, involving services to have people killed.

The Silk Road resurfaced as Silk Road 2.0 and was run by new owners, but more arrests followed, and the site was taken down. Other versions have appeared, including the current version, Silk Road Reloaded, which operates on I2P. It's only a matter of time before this is taken offline, likely to be followed by further incarnations.

Wrong Side Of The Tracks

It's clear that the Dark Web isn't a place for everyone, and there are undoubtedly plenty of reasons to avoid it. Luckily, that's not hard. You won't accidentally stumble into the Dark Web, as you need the special software to access it, so you don't have to worry when browsing the internet.

Should you venture into the Dark Web? We'd have to say no, not really. We wouldn't advise using the Dark Web, because there's simply no reason for most people to do so. It's probably true that the Dark Web is no more unsafe than the normal internet in terms of security on your PC, and many stories you hear about it are often hyperbolic, but it's also clear that the users of it and those who do business on there aren't always good people. Would you feel safe walking through a real-world marketplace where guns, drugs and even assassination contracts were being peddled? No, of course not, even if the majority of the people selling their wares were totally legal and decent. It only takes that small percentage to make things dangerous, and the internet and its Dark Web are no different. **mm**



Encrypting Portable Storage

We look at how to protect your data when you take it on the move

Whether it's in the form of an SD card, USB thumbdrive or external hard drive, portable storage has never been so cheap. But oddly, in a world where everything has passwords – and sometimes extra security verification procedures on top of that – all that most people need to get access to the data on your portable drive is a spare USB port.

It's fair to say that the documents, photos and backups on a portable drive have great potential to be used for fraudulent purposes if they fall into the wrong hands, so it's odd that many of us still don't choose to protect the files with some form of security or encryption. Portable storage, by its nature, has a high likelihood of ending up in the wrong hands. Just ask every politician who's ever left a briefcase or folder on public transport.

So how do you encrypt your personal storage? Luckily, it's not that difficult. And to prove that, we've put together a step-by-step guide that'll work for any USB-based storage device.

Types Of Encryption

There are various levels of encryption you should look for, but ideally you should use international standards as a guide to the level of protection you're receiving. 256-bit AES encryption is a high-security version of encryption, which is currently safe (and should remain so for the foreseeable future), but anything higher is acceptable.

Encryption, whether in hardware or software, means that files cannot be read from the storage without the necessary key, even if the platters or memory banks are accessed directly. Anyone trying to access the files would find only unintelligible gibberish.

The most basic type of encryption happens in software. The advantage of doing it this way is that you can use it to turn any standard drive into an encrypted drive. The disadvantage is that the software must be accessible on any machine you wish to access it on. If your data is encrypted using a program that only works on Windows, you won't be able to access the data on a Mac or games console, for example.

Hardware encryption, meanwhile, is performed by the drive itself. This means the drive is compatible with any USB-compatible device, because once the drive is decrypted, it works like any standard USB drive, but it's also limited to the hardware itself, meaning you can apply it more generally to other storage devices. The price of hardware-encrypted drives is much higher due to their increased complexity and a premium on security.

Although some guides assert that encrypted drives are slow, this is not the case other than USB 2.0 drives being slightly more popular due to the slower market throughput of encrypted drives. If you get a USB 3.0 drive with hardware encryption, it will be no slower to access than any standard USB 3.0 device. Indeed, it may actually be faster than software-encrypted drives because the decryption is done directly using an AES chip, rather than through a software implementation of the same.

So given that you can't add hardware encryption to existing hardware, we're going to concentrate on something you can do: encrypting your portable storage in software.

Encrypting Your Drive

Many guides advise you to use Microsoft's own BitLocker to protect your files, but this software is only available in certain versions of Windows and if your system has certain types of hardware installed. Rather than try to account for every configuration, we're going to suggest a free third-party decryption system that works on every version of Windows, but don't be discouraged from trying Bitlocker if your Windows installation supports it.

There was a time when we would have recommended the free software TrueCrypt, but it mysteriously discontinued last year. There are plenty of paid-for alternatives, but the best free one to TrueCrypt (and BitLocker) is DiskCryptor. It allows you to encrypt any file, drive or external storage device and uses a number of different encryption algorithms including AES, Twofish, Serpent and more. It's open source and still under active development, and you can download an installer or a portable version from **diskcryptor.net/wiki/Downloads**, so do that before following these instructions.

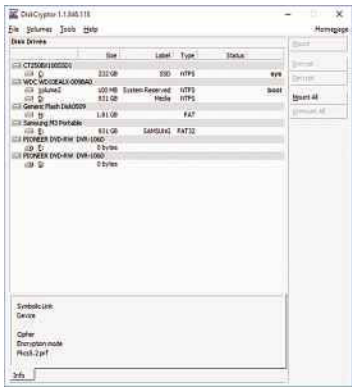
Step 1: Run DiskCryptor

Once you've installed Diskcryptor and rebooted, you'll be able to access the software. Remember to run it with administrator privileges, otherwise its functions will be unavailable to you, but you should be prompted to do this before you can access the program. The software's main screen will look something like this, with a list of your installed drives, their capacities, labels and types.

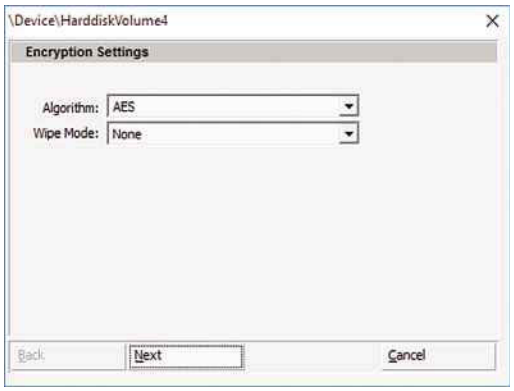
Step 2: Pick The Drive You Want To Encrypt

In this case, we're going to encrypt the 2GB flash drive (drive H: in the visible list), so click it and hit 'encrypt' on the right. You'll be given the option to select your encryption settings, which means choosing an algorithm (AES, Twofish, Serpent or some combination of all three) and a wipe mode (either none, one of two versions of US DoD 5220.22-M or Gutmann mode).

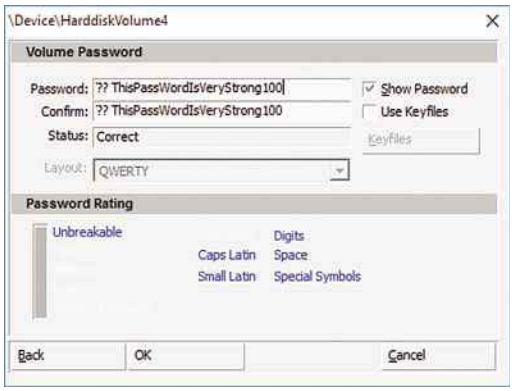
Unless you have a good reason for selecting another kind, AES encryption should be fine. If you want to keep the contents of the drive intact, select 'none' for Wipe Mode, but if you do want to erase the existing contents, any of the



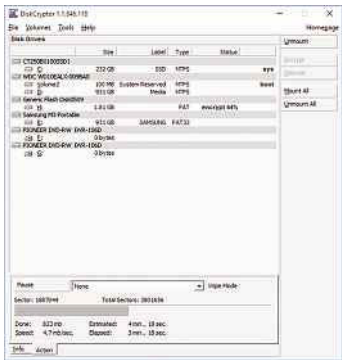
Step 1: Run DiskCryptor



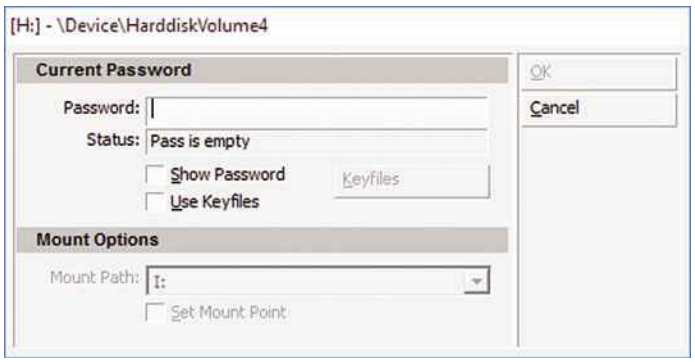
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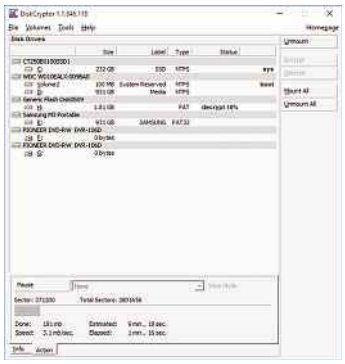
Step 3: Choose a password



Step 4: Wait for the wipe and encryption to complete



Step 5: Accessing the encrypted drive



Step 6: Permanently decrypting a drive

other three options will suffice. When you're happy with your choices, click 'next'.

Step 3: Choose A Password

The next step involves choosing a password, which you'll need to enter to decrypt the contents of the drive. If you lose this password, the contents of the drive will become permanently irretrievable, so don't forget it under any circumstance!

As ever, when you choose a password you should select it using best practices, which mean it should be long, memorable and use a combination of numbers, punctuation and cases. A passphrase may suit you better than a string of random letters and numbers, but feel free to use a password generator. In any case, coming up with something secure is very important here, as a weak password renders encryption virtually moot.

The password rating at the bottom of the dialogue box will rate your password for you, highlighting the security features you've included and allowing you to manually refine your password. You should also confirm the password in the second dialogue box, and if you wish to read it, tick 'Show Password'. We recommend you do this so you can be certain you haven't made any typos. Making the same mistake twice without realising would be disastrous; it would render your data irretrievable unless you could replicate it again!

If you have a keyfile, you can also add it here by ticking the 'Use Keyfiles' box and then clicking 'Keyfiles', but if you're a home user, you'll know if this is desirable for you or not. If you don't know what it means, you can assume not.

Step 4: Wait For The Wipe & Encryption To Complete

Once you click 'OK' on the settings dialogue, DiskCryptor will return to the main application and show a progress bar at the bottom of the screen, which tells you how the wipe and encryption is proceeding. In the 'status' column you can see a numerical percentage, while the data at the bottom will show you the number of sectors encrypted (of the total amount), as well as the speed in megabytes per second, the total megabytes completed, the time taken and the estimated time left.

You can pause the process by hitting 'pause'.

Step 5: Accessing The Encrypted Drive

When the drive has been encrypted, it will automatically be 'mounted', meaning you can access the encrypted files. If you unmount the drive, whether by manually doing so or by removing it for use in another system, the contents will be inaccessible unless they're decrypted.

To access the drive again, you have to run DiskDecryptor and mount it, inputting the correct password when prompted.

In some cases you'll be able to choose which drive letter the contents are mounted under (i.e. if they're not already assigned a drive letter), but this isn't a common situation for portable drives, which Windows usually gives a drive letter the moment they're detected.

While the drive is mounted, you can access it through any standard piece of software. The OS will treat the drive as if it's completely unencrypted up until the point where your system is rebooted or the drive is physically removed.

If you try to access an unmounted, encrypted drive through something like Explorer, Windows (and any other operating system or hardware) will probably detect it as unformatted and may attempt to format the drive. Remember that if you allow the format to take place, the drive's contents will be wiped.

> **"Unless you have a good reason for selecting another kind, AES encryption should be fine"**

Step 6: Permanently Decrypting A Drive

If you're ready for the drive to be decrypted permanently, simply mount it using DiskDecryptor and then click 'Decrypt' on the right (which will only be available if the drive is encrypted). When you put in the right password, the contents will be decrypted in a similar process to the way they were encrypted.

Note that if you don't want to keep the files that are stored on the drive, you can bypass this process by simply reformatting the drive. This will wipe it clean, but the new file system will be unencrypted and ready for use.

Hardware Encrypted Drives

s. These perform their encryption in hardware and are therefore an order of magnitude harder to crack than software encrypted-drives. However, at the same time, they're often considerably more expensive, and the encryption can only be applied to those drives, whereas most software solutions can be employed on virtually any type of storage. Another benefit of hardware encryption and decryption is that it doesn't require any specific software, so you can use it in any piece of hardware.

And in case you're not sure what hardware is available, here are a few encrypted storage brands you might want to look out for.



iStorage DataShur



Kingston DataTraveler Locker+

iStorage DataShur
iStorage's range of encrypted drives have 256-bit AES encryption, a hardware keypad that you can use to unlock them securely, support for multiple users and access privileges (so you can assign a code that's read-only, for example) and a protective metal case to ensure it resists damage. Its USB 2.0 drives range from 4GB (£40) to 32GB (£100) while the USB 3.0 versions come in capacities from 30GB (£170) to 240GB (£320).

iStorage also produces the 'DiskAshur' range, which are encrypted portable hard drives of a similar pedigree.

Kingston DataTraveler Locker+
Made by RAM and memory specialist, Kingston, the DataTraveler Locker+ USB 3.0 drives have 256-bit AES encryption and USB cloud functionality, which can keep online backups of your data. Prices range from £11 for the 8GB version to £54 for the 64GB version. Not as advanced as DataShur's USB sticks, but just as secure.

Lexar JumpDrive M10
Beware of these Lexar JumpDrives: although they might appear to be encrypted in hardware, they aren't. They actual use EncryptStick Lite software to encrypt and decrypt the contents, which is a more secure option than buying a star. unencrypted USB key, but also not much better than simply using something like DiskDecryptor with any other drive. They are cheap (£10 for the 16GB version and £20 for the 32GB version), but that's because they're essentially just regular, encryption-free drives.

Can Encryption Be Broken?

In theory, encrypted files are always safe from unauthorised access and will be now and well into the era of quantum computing, when the exponential power of quantum processing may render current forms of encryption trivial to break. But at the same time, it's not impossible that circumstances may arrive that render encryption beaten in its own right.

For example, the Heartbleed bug, once it was discovered, made OpenSSL encryption breakable at a single stroke. Some researchers recently cracked 4096-bit encryption by listening to a CPU with a powerful microphone that allowed them to divine the decryption key by recognising the repetition of the noise it made before it accessed encrypted data. Some forms of encryption may even have backdoors built in to ensure that the security services can access the content even if its owners refuse to give them access.

> **Rather than spend time encrypting your storage in software, you could simply opt for pre-encrypted drive**

In short, nothing on a computer is definitely, permanently secure. But strong encryption is the closest you can get, and in a world where most people you meet aren't affiliated with the secret service and don't have access to high-powered listening devices, you can be relatively sure that your data isn't going to get stolen. At least, not for now. **mm**



Lexar JumpDrive M10

Microsoft's Sting In The Tail: Updategate



Mark Pickavance looks at Microsoft's foray into making friends and influencing people

A few months ago, Microsoft drew some flak for installing an app onto Windows 7 and 8 users systems that was intent on pushing Windows 10 on them.

What was rather odd about this was that it offered to reserve a copy for you, despite there being absolutely no chance whatsoever that Microsoft would run out of them, as they weren't boxed items.

A few well-placed questions revealed that what it was really doing was downloading files to the PC ready to do the installation. This seemed entirely logical, even to those outside Redmond. As usual, Microsoft failed to communicate and managed to make it seem worse than it was.

Yet in a single surgical strike, getting the user to sign off on the 'reservation', Microsoft was able to spread the transfer of large install files over a much longer time frame and make the system ready for when the user asked for that installation.

A few people moaned at this, in particular those with limited disk space, saying they didn't realise the implications, but most accepted that by reserving they'd given tacit approval.

And then the files for Windows 10 installation started turning up on machines that hadn't made any such request, and lots of people began to give Microsoft the sort of grief such inconsiderate actions probably deserve.

Updategate

I've stated many times online and in this magazine that a portion of my writing career has been subsidised by Microsoft's seemingly incomprehensible inability to communicate. And we're not just taking about product and service changes; this company has a comprehensive problem relaying the simplest information to its customers and partners, even if a change it's made has significant consequences for those people. But some things it does are actually beyond explanation, even for 30-odd year veterans of interpreting its mystical runes.

Now labelled 'updategate' (by those who can't help adding the word 'gate' to anything they perceive as scandalous), this fiasco materialised around the middle of September.

However, I realised that something was wrong a few days before it become public knowledge, when my daughter dropped me a line to say that she'd already used her mobile data budget for the month, just two days after it had been reset.

She's a university student in her second year and changing her rented accommodation. So temporarily without broadband, she's used her mobile phone to provide access for her laptop to the internet. And in the blink of an eye, her 1GB monthly allowance vaporised.

The culprit I suspect was Windows 10, or rather the installation files for that OS, which magically arrived on her machine, even though she'd never clicked to ask they be downloaded or 'reserved' anything.

There are two ways to find out if you've been splatted in this fashion, and the first is the update KB3035583. The other is a couple of hidden folders usually in the root of the C: drive. One is called C:\$WINDOWS.~BT and the other C:\$Windows.~WS, and if you're on broadband, you might find the second folder has more than 10GB of Windows installation files in it.

When this story first broke, a number of high-profile technology websites entirely ignored it, and a few even went as far

as to describe those that did cover it as engaging in "tinfoil hattism".

Not long after this, rather too many people confirmed the story to ignore, and a few tech pundits even took to their own talk-backs to eat humble pie. The well-respected Woody Leonhard on InfoWorld admitted, "Man, was I hornswaggled by this one."

Later on, when he'd simmered down a little, he wrote this: "Microsoft has already proved conclusively it can install any program it wants on your Win7 or Win8.1 PC and have it do whatever it wants. Now the folks at Microsoft are now demonstrating they can push massive amounts of crapware to hundreds of millions of PCs – using customers' bandwidth and taking up real estate on customers' main drives – without a wink, nod or notification, much less a request for permission."

Some others weren't as controlled in their assessment, and lots of people got very angry indeed. Probably justifiably so.

At the time of going to press, Microsoft hasn't responded to any requests for explanation as to why it thinks it can dump 10.3GB of Windows 10 on any PC it likes, regardless of the impact it might have on the user and their computer, and the cost implications for many.

Is there a line these company won't cross? The answer to that is apparently no, and once it's crossed that line it'll dump files there just so you know it's been to visit.

> **"While you might have bought the PC in your home, it's actually really Microsoft's"**

If I were CEO Satya Nadella, I'd brace myself now, because the backlash on this choice is going to be brutal.

A Course Of Action

The problem with any information I might provide to avoid you being kicked in the data package are already too late. Because if you've used the automatic updates to Windows, like all good computer owners should, then you've probably already got this potentially unwanted gift on your system.

If you're a Windows 8 user, it's possible to tell the system that you're on a metered connection, and hopefully it will excise more control. For Windows 7 users, other than disabling updates, which isn't a great plan, I'm not sure what's best to do.

In terms of the really bad things that Microsoft has done to its customers, this is right up there, and in some jurisdictions there could be legal implications to it putting a whole OS on your computer without asking first.

We've all become rather too blasé about updates, possibly because of Android, and this is a wake-up call we probably all needed.

Microsoft is clearly of the opinion that while you might have bought the PC in your home, it's actually really Microsoft's, and it will do what it likes with it, even if that directly contradicts your wishes.

What more than blows my mind about this one was that it had seen how sensitive people were about this in July, but it entirely ignored that when moving to this new aggressive deployment of Windows 10. What next? Will Windows 10 install over your Windows 7 or 8 beyond the user's control?

That might have seemed ridiculous a few months ago, but appears significantly less incredible now.

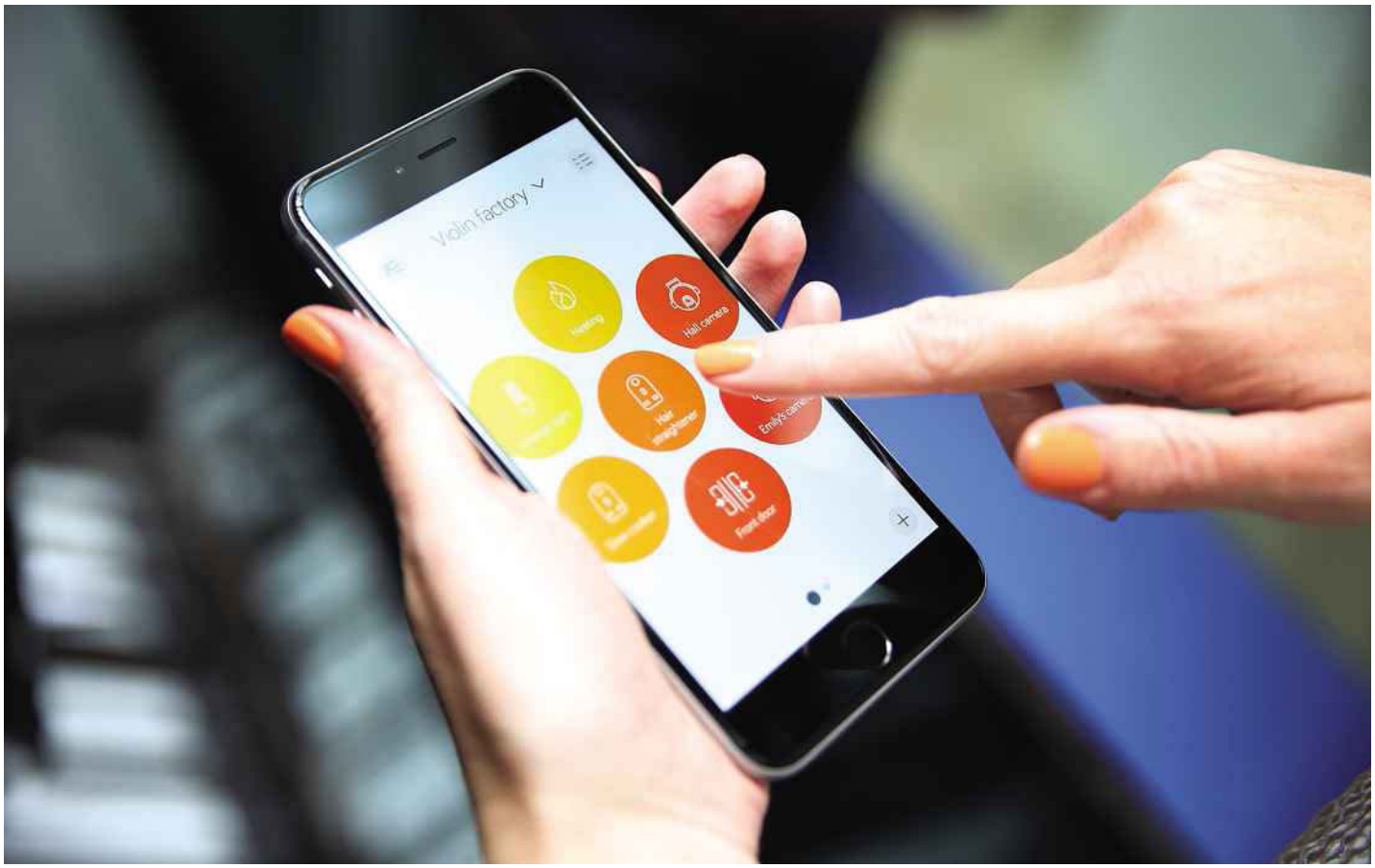
That Microsoft can't actually communicate why it's done this (possibly because it has no idea why it did it either) is one of the worst aspects.

It's like the scorpion in the old Aesop's fable, which stings the frog knowing they'll both die in the river. Why did you eat my data allowance, abuse my trust and put 10GB of files on my PC without asking? "Its my nature..." said Microsoft.

However, in this instance, it's not even leaving its frogs with anything that existential to ponder. **mm**



If you choose to reserve Windows 10, then this is what you'll get, the installation files ready to use. And if you don't, this is also what you'll get, even if you never intend to upgrade. Consistency is everything, it seems



Hive Of Activity

Not many companies like to take on the might of Google but with Nest recently unveiling its latest, thinner smart thermostat, David Crookes talks to a well-known British company aiming to claim it own sizeable share in the connected home market



The Next Big Thing, we have so often been told, is not the latest smartphone, wearable or revamped operating system. It's the connected home – or smart home, as some like to call it. Research by Time showed that 84% of people in the UK are interested in buying at least one smart home device, with 58% considering smart lighting, 56% household utilities and 54% security.

There is no shortage of companies lining up to offer an array of items in return for customers' well-earned cash. At the beginning of September, Nest announced that it was revamping its smart thermostat, making it thinner, blessing it with a better display and including a feature called Furnace Heads-Up, which keeps an eye out for potential overheating. In July, it unveiled a revamped smoke detector and a new security camera. It also has an initiative called Works with Nest, which allows everyday items from Zuli smartplugs to fans to washing machines to hook up with its own products.

But even though the company makes the majority of its devices available in the UK, another well-known British company is looking to make greater inroads on these shores. What's more, it seems to be winning people over, firmly knocking Nest into second place this side of the Atlantic.

It's natural that Nest gets a lot of press coverage given its connection with Google. It was also an early pioneer, introducing the Nest Learning Thermostat in 2011, following it up with the smoke detector in October 2013. It was at the centre of a $3.2 billion takeover the following year, and eyes are firmly on Nest because of the resources it has – some 460 employees – and also because of the great brains that will be beavering away within the walls of its offices.

There's no doubt that its products are impressive and that it has an important role to play in the development of smart home technology. But in the UK, Nest has some serious competition in the guise of the old former state-owned giant British Gas, and in the past month or so, the latter has expanded the range of products it has to offer.

These range from the Hive thermostat which goes head-to-head with Nest, a smart plug, smart lighting, window and door sensors and motion sensors. It also has a multizone add-on, which allows different areas of the house to receive different levels of heat. Don't tell Sid, but British Gas is actually doing some pretty cool stuff, and it's all controllable through a smartphone or tablet.

"Don't tell Sid, but British Gas is actually doing some pretty cool stuff"

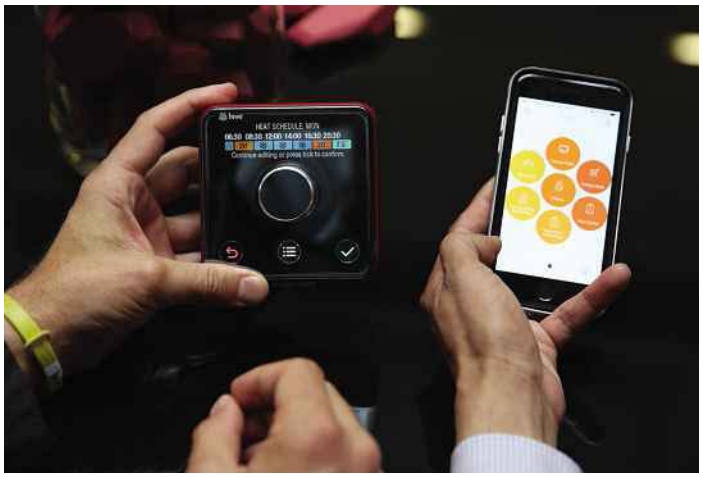
Kass Hussain has a greater grip on all of this than most people. He's the director of British Gas Connected Homes, which oversees the development of the Hive products, and his ambition is stark. He wants Hive to become as powerful a smart home ecosystem as Nest could ever be, and he wants it to eventually reach out and touch the majority of items that will go to make up the so-called 'internet of things'. What we're seeing from Hive at the moment is only the start, he says, but he has to take things slowly. The connected home industry will only flourish, he insists, if people are introduced to it gradually.

"Regardless of what you hear in the press, people are not ready for a Jetsons lifestyle and we are mindful of that," he says. "What









resonates in my head is our customers saying, 'give me control but don't take control from me'. This is so important to us."

For this reason, the Hive thermostat started in a relatively simple way. It connected into the heating system and allowed the temperature to be increased or lowered via an app. It was possible to create a schedule and to see a heat history, but that was pretty much it. "We could have loaded Hive with lots of clever features, but we didn't," explains Hussain. "What we wanted to do is take what is on the wall and make it easier to control on a smartphone. We knew that programming the phone would be easier than programming the thermostat, which most people admit to not understanding."

But now that many people have become familiar with the app and what it can do, Hive is getting ready to up the ante. "By taking small steps and building them up – which is what we're doing with Hive 2 and with the new products – we are earning people's trust," he adds. "Only then can we become more intelligent about things. It has to be a journey."

Hive 2 is the second version of Hive Active Heating. Like the Nest thermostat, it looks highly stylised, having been designed by Swiss entrepreneur Yves Béhar (it even comes with a choice of colourful frames to suit people's décor or taste). In making it attractive, Hive and Nest have changed the perception of thermostats from being a beige blot on the wall to something that is trendy and in need of highlighting. Thermostats are now gadgets, and thousands of people are buying into it. What's more, they're showing people just what's possible in the home.

This is where things become interesting. Hive has 200,000 customers, which is far in excess of its rivals ("We sell more in a week than our competitors do in a month or two"), but then it does benefit from having the might of such as well-recognised company behind it. Even so, that makes it the most important player in the UK right now when it comes to smart homes, and Hussain says that it will do all it can to remain in that position.

"We do keep an eye on the competition, and there are some great products out there," he says. "But I think it's a good sign there are lot of competitors in this space. Competition breeds innovation, and it provides value for customers. It keeps us on our toes. But there is no organisation in the UK with the complete end-to-end experience that we have. We have retail partnerships and a large in-house tech development team. We have fantastic engineers – 10,000 of them making 50,000 trips. No one is more qualified than us to know British homes."

The aim of companies such as Nest and Hive is to get around the problem that had blighted the connected home market for some time: the launch of individual products that needed their own apps and their own hardware but didn't work well together. Hussain predicts that the industry will eventually consolidate and that only a handful of providers will exist – "perhaps two to five" – each of which will be able to sell a full suite of products and services. "The ones that don't provide everything will be the ones getting unplugged," he adds.

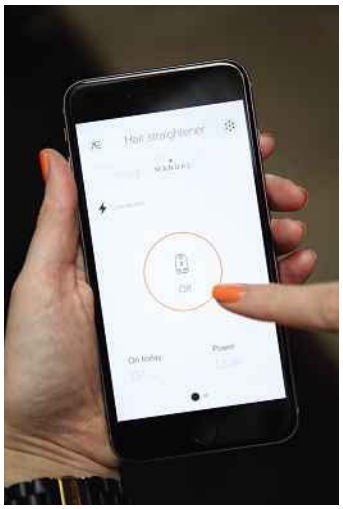
Just as crucially, Hussain believes smart homes are not just a fad but have a wide range of uses, which have the power to revolutionise the way we live. Not only does he point to research commissioned by British Gas, which discovered 7.8 million homes were being unnecessarily heated when they were empty, he says devices such as smart thermostats can also empower people.

"I received two really nice emails," he explains. "The first was from a woman who wrote to say she was a single parent who didn't have loads of cash. She had Hive fitted and found that although she wasn't spending more or less money, her family was warmer than before. I wrote back and asked what she meant, and she said, 'Well, what we're finding is that we're turning on the heating as much as before but we're there and so getting more warm for the money we spent'.

"The second was from a woman who was in a wheelchair and whose husband had Alzheimer's. By the time she'd sent him upstairs to change the heating, he had forgotten what he went up there for, which is a really tragic story. But with Hive she could do it from the comfort of where she was."

Even in more regular circumstances, Hussain says smart homes are making a difference, with the devices seemingly winning over sceptics. "And we're not talking about the typical early adopters







of tech but by regular customers across all demographics and technical capabilities," he says. When people get smart home products installed, there is a disproportionate level of use for the first two or three month, he continues, but the key thing is that they continue to be used.

"What we find is that you don't get it until you get it," he says. "When I took my Hive heating home to my wife, I got the typical rolling of the eyes and the comment 'not another gadget' but within a few weeks she became a heavier user than I did. We find that 61% of our customer base used those heating controls very day during the winter period, and that's a phenomenal statistic for people who never bothered engaging in heating in some shape or form at all. I don't know why people are getting excited, but they are."

> **"We don't believe in a closed system, and we think you need to allow consumer choice"**

Those customers make suggestions about new features, and one of the biggest is greater integration with other items. Although Hive has smartplugs, thermostats, lighting and sensors, the key is getting them to work together. In the right combination, they could be used to bolster the security of a house – a sensor picking up on movement, activating the lights and switching on the TV (maybe even turning up the heat to make it mega uncomfortable (or not)) – but Hussain has other things in mind.

"To date, we have never used the word security," he says. "If you want an alarm system that the insurance company will accept, then go to a mainstream provider. That is not what we are trying to tackle today. But we are trying to tackle peace of mind. The smartplugs have an element of security in there, but they have other uses than making a lampshade come on and off. If my wife and I leave the house, we may wonder if we've turned the iron or the hair straighteners off.

"We may be unsure if the windows and doors were properly closed. We want to make it so that you don't need to turn the car around for a double check, and there are all kinds of applications. It's amazing how kids will turn lights on but not off, for instance; you could switch them all off with a single action. But you can also be clever: if you have left the window open, then there could be an instruction to turn the heating off."

Recipes are a fundamental part of the connected home. There is an existing app called IFTTT, which allows people to create internet recipes already, alerting to emails or sending items to Dropbox when a certain action is made. It's still niche, but with smart homes this kind of thing should become second nature, or at least that is what Hussain hopes.

"This is where things get exciting," he says. "We want customers to create a backbone and update their system piece by piece with new components. When you start to link things together with recipes, it's like building the infrastructure of the roads in the home. Let's say someone is in the driveway with a smartphone in their pocket. Hive knows he's home so turns the heating and lights on and even activates a third-party music system. So you can start to see that multiple devices can interact."

The third-party aspect is intriguing. Nest, as we've already seen, allows other companies to work within the ecosystem it is creating. Is this something British Gas is doing with Hive? "We don't believe in a closed system, and we think you need to allow consumer choice," Hussain says. "We also want to open up to partnerships that will allow us to expand our system and make it even more useful. It also means we can do things that we are not experienced in doing. For example, would I buy a door lock from British Gas or Yale? I think we know the answer, and that shows that many things are better done in a partnership. We will certainly be speaking with other companies.

He says British Gas has no interest in delving into every part of the connected home itself. "You have to open your API and software development kits for greater integration of different devices and give users the ability to control those devices with things like IFTTT and Life360," he continues. "That category has not been announced, but we are looking at that, and there will be an announcement next year." The buzz around Hive is set to intensify, we feel. **mm**

What Else?

There are other companies looking to make in-roads into the smart home market aside from Nest and Hive. In terms of thermostats, Honeywell's EvoHome has emerged as one of the best, but you need thermostatic radiators valves installed – if have too many radiators, this could prove to be expensive. Tado is a strong competitor as well. It can tell who's in the house and controls the heating to fit the circumstances. If you're in and it's too cold, then Tado will make it hotter; if you're on your way home, it will make the house more comfortable for when you arrive.

But of course, smart homes are about more than just thermostats. The Philips Hue connected bulbs not only work in conjunction with smartphones; they also change colour to reflect your mood. Belkin's WeMo has smart lighting, cameras and smartplugs, which are bought individually, allowing you to make a connected home tailored to your needs. It's perhaps important to think wisely about which system you want to go with, though. Having different systems doing different things will mean you doubling up on apps and finding that one set of devices won't talk to another.

Component Watch

Got a new Intel processor? Maybe one of these motherboards deals will appeal...

The release of Intel's Skylake CPUs means that many people are looking to do a full upgrade of their system in the near future, and that means buying a new Intel 100-series motherboard with support for Socket 1151 chips. But how good are the prices you can find on these potentially expensive purchases? We've done the work so you don't have to.

Deal 1: MSI B150M PRO-DH
RRP: £59.99 / Deal Price: £58.41



The cheapest 100-series board on the market right now, this MSI board uses the B150M chipset, which is surprisingly fully featured compared to the usual stripped-back budget motherboards. You get three PCIe slots, 12 USB ports and four DDR4 RAM banks for your money, as well as gigabit LAN and six SATA ports. Gamers should avoid it, but everyone else can safely start here.
Where to get it: Ebuyer – bit.ly/1PwPZm0

Deal 2: Asus H170M-E D3
RRP: £79.99 / Deal Price: £70.84



This DDR3 board from Asus uses the H170 chipset, giving you a little more for your money. You get four RAM slots, three PCIe slots and one PCI slot, only four SATA ports, but support for M.2 storage is included too, as well as RAID support, 14 USB ports and gigabit LAN. It's more than most people will need, but (RAM aside) it also makes a good base for future upgrades.
Where to get it: Dabs – bit.ly/1MKNfUu

Deal 3: ASRock Z170 Pro4S
RRP: £89.99 / Deal Price: £82.61

ASRock's model is the cheapest above the £80 point and makes this well known. The first full-size ATX board we've looked at, it has five PCIe 3.0 slots (including two x16, allowing multi-card graphics setups), six SATA ports, two SATA express ports, an M.2 port, up to 20 USB ports and full overclocking support. Definitely one gamers will benefit from looking at!



Where to get it: Ebuyer – bit.ly/1MKNpLJ

Deal 4: Gigabyte H170-D3HP
RRP: £99.99 / Deal Price: £90.66



Gigabyte's board packs in additional features, with USB 3.1 type-A and type-C support, ambient LED lighting, gold-plated sockets and more besides. It's an H170 chipset, so it doesn't support overclocking, but you get four DDR4 RAM slots, four PCIe slots, three PCI slots, an M.2 port, two SATA express ports and gigabit Ethernet. A good choice for high-end non-gamers.
Where to get it: Scan – bit.ly/1WkLNK5

Deal 5: Asus Z170-K
RRP: £109.99 / Deal Price: £102.34



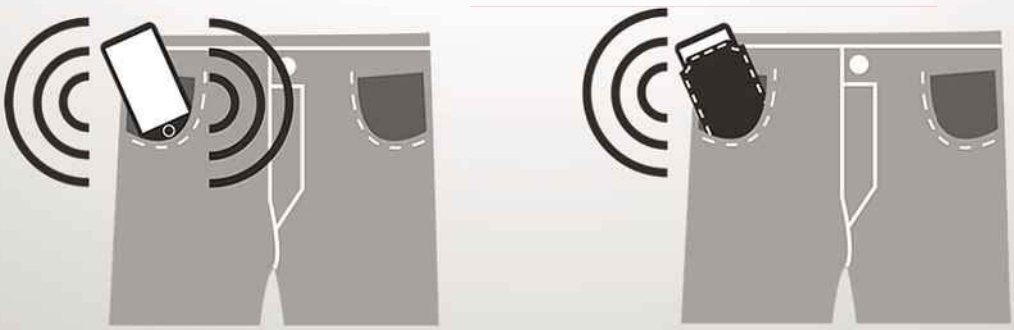
It's not the most expensive board on the market, but it's the most expensive we'd want to buy. Loaded with USB ports, PCIe slots (six in total), six SATA ports, an M.2 port, a SATA Express port, two-way SLI and three-way CrossfireX support, CPU overlocking, four DDR4 slots – whatever you want, this motherboard has it. If you have the money, it'll make it worth your while to buy one whatever type of system you're building – but especially for hardcore gamers.
Where to get it: Pixmania – bit.ly/1YDcbkK

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Fix-A-Beeb Day A Success

Amazon Takes On The Tablet Field... Again

New Fire model takes on budget competition

By the time you read this, Amazon will have released its latest Fire tablet line, this time taking on the budget end of the market. Costing a penny less than £50, providing other budget tablet providers likes Tesco with food for thought. This latest model is made up of a 7" IPS display, a quad-core 1.3GHz processor and fairly pointless, low-resolution rear- and front-facing cameras. Crucially, it also houses a microSD slot for expanding capacity up to 128GB and it will run Amazon's Bellini software for the Fire range. Presumably aiming this at the younger, more carefree end of the buyer spectrum, Amazon is also actively marketing this as 1.8 times more durable than the iPad Air 2.

Which brings us to firm's attempts to link this in with the Prime service; likely where it sees the real profits coming from. Like Apple, it seems to reckon that if it attracts consumers to its products (cheap ones in this case) they're more likely to use the entire ecosystem. For example, by including a feature called On Deck, users will receive automatic downloads of TV shows and films – but only if they are Prime members.

Will you be tempted to part with £50 for Amazon's latest Fire? We have a feeling that many will. There are better-spec'd, similarly-priced tablets out there, but this comes with the branding and the ecosystem to make a difference.



QUICK BITS... **German airline Lufthansa is to provide access to broadband Internet on its short- and medium-haul**

TNMOC restores over 30 Micros

Thank goodness for volunteers. A plucky band of skilled BBC Micro enthusiasts descended on The National Museum of Computing at Bletchley to take part in a Fix-A-Beeb event to restore a bunch of BBC Micro computers.

The really good news, though, is that by the end of the day no fewer than 36 computers had been restored, ready for to help teach about coding in the TNMOC Classrooms The restorers ranged from a teenager to seniors, and they came from far and wide across the UK to use their expertise to help the next generation of would-be programmers. The Museum was only expecting around 20 machines to be restored, so this was quite an effort by all involved.



Magix Makes More Movies

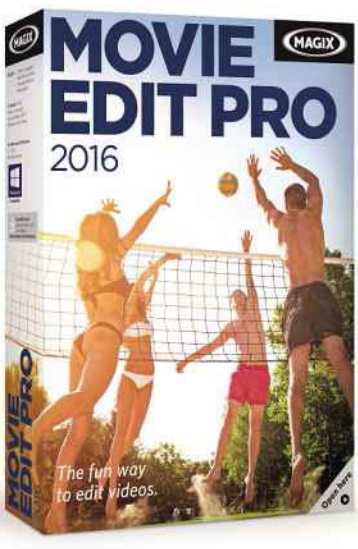
Movie Edit Pro package updated

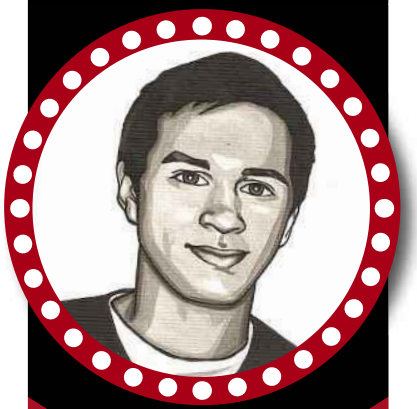
Magix has announced the 2016 iteration of its Movie Edit Pro package and there are, as you would expect there to be, a host of new features included.

Magix says that it has focused on optimising the user experience with this package. The reality of that statement is that the firm has made a bunch of improvements and additions to try to entice you to buy this effort over previous ones. So, for example, this supports H.265 with hardware-accelerated decoding allowing for decoding straight from the graphics card, freeing up the processor and improving performance while editing. High-quality image stabilisation helps when working with footage from action cams and the package also comes with 360° editing for panoramic footage.

Throw in over 200 new templates, the chance to keep music and images in sync with the beat-based editing feature in the Plus version of the package, as a Premium package that additionally includes a bunch of presets for lens correction alongside features such as auto contrast, hue adjustment and RGB colour shift, and you have yourself a revamped, improved editing suite.

Movie Edit Pro will set you back between £50 and £90, depending on exactly the options that you require, and thus which version you opt for. To take a look at the various versions, the website you will be wanting **www.magix.com**.





No matter how much you like desktop PCs, you can't really deny that the world of computing has largely moved on to mobile platforms. For a while, practically everyone had a desktop in their home, whether it was a self-built or a pre-built system. Nowadays, of course, many of us have a tablet or two and a smartphone. If there is a 'proper' computer in the house, there's a good chance it's a laptop. But is the desktop market dead? Not at all.

The difference today, though, is it's a far more specialist market. The people that buy PCs these days are generally interested in the technology, rather than just having a way to surf the web or write the odd letter or essay. And let's not forget the influence of gaming. The huge success of Steam shows there are still plenty of people using desktop PCs these days, and they still want the best technology they can afford.

That's why I remain confident in the future of this platform and why I personally enjoy the subject matter we're covering in this issue.

Until next time,

Anthony

Editor

Meanwhile... On The Internet...

Some days you sit down to check out your social media platform of choice and immediately realise that you've missed something. There's something, everyone suddenly seems to be talking about; it's appears to be in what, to the untrained eye, resembles code. A wave of jokes, pictures and hastags that you have no reference point. The race is then on to get in on the joke as soon as possible.

September 20th was such a day, dear reader. The day we Googled **#PigGate**. A day that, to paraphrase everyone's favourite Sith Lord (sorry all you Reven fans out there, but get over it...), will be 'long remembered' by satarists, meme makers and, well... pretty much any UK resident with a Twitter or Facebook account.

The details will not be repeated here; they shall remain in *Call Me Dave* (**tinyurl.com/MMnet82a**), an unauthorised biography of David Cameron penned by former high-ranking Conservative Lord Ashcroft and journalist Isabel Oakeshott, and the now-infamous front cover of the *Mail On Sunday,* wherein the noble Lord's claims about Mr. Cameron's behaviour whilst at University were serialised. Suffice to say, the social media world tilted a little on its axis a little, and will probably never return to full-square.

Pretty much all of the jokes, references, image macros, videos that relate to Ashcroft's tale of porcine impropriety could are NSFW, and thus the links that follow come with a mild warning. We've tried to keep it as, um... savoury as possible, though. Lord, isn't everything just a pun these days?

The outstanding contribution to the avalanche of comedy, photoshopped pictures and *Peppa Pig* references (**tinyurl.com/MMnet82b**) came, somewhat predictably, from the peerless Cassetteboy (**tinyurl.com/MMnet82c**), which proved that the nigh-on twenty years the duo has spent refining its cut-and-paste audio/visual montages from abstracted, surreal Victor Lewis Smith-style (**tinyurl.com/MMnet82d**) comedy curios and parody tunes into laser-guided political satire (usually, but not exclusively, targeted at the right-wing of the political spectrum) has been time well spent. They took little more that twenty four hours to put together the quite wonderful *Getting Piggy With It* (again, NSFW really: **tinyurl.com/MMnet82e**) as sublime a 30 seconds of YouTube mastery as you'll ever see. Gentlemen, we salute you.

While some people tried to turn the irreverence into a serious discussion – whether it be regarding Lord Ashcroft's tax affairs (**tinyurl.com/MMnet82f**), the PR implications (**tinyurl.com/MMnet82g**), the international reputation of the UK or a wider debate on the class system (**tinyurl.com/MMnet82h**) – others were just happy to throw about jokes and jibes. The irony is, of course, if the jibes go on for long enough, that may well just be enough to undermine Mr Cameron's position.

While 4Chan has been involved in more than its fair share of controversy over the years, it was always a little bit likeable. Firstly for some of the great things it has bought to internet culture (**tinyurl.com/MMnet82rr**), and for the way its minder, Christopher 'moot' Poole seemingly single-handedly tried to keep it true to initial optimism that the internet could be haven for freedom of expression. Indeed, when he announced his plan to step back from 4Chan in January of this year, it seemed like the end of an era, and that vision.

Now, 4Chan is the property of Hiroyuki Nishimura, the man behind 2Channel – a site that inspired Poole to create his (**tinyurl.com/MMnet82q**) – and It seems like everything has come full circle. Poole has, as always, been honest in interviews as to why he became tired of dealing with the problems 4Chan created, and why he's moving on (**tinyurl.com/MMnet82s**).

If, like us, you've ever wondered whether a story on social media is real, how do you go about confirming it? We've always noted **snopes.com** as being our first port of call in an internet storm – and it's still the first place we'll look if we doubt the veracity of a viral post. However, *Lifehacker* has recently produced a handy guide (**tinyurl.com/MMnet82i**) to checking out the source of a story yourself. It's comes in response to a viral image that spawned a stories of ISIS terrorists travelling into Europe within the throng of people currently navigating their way here from Syria, Eritrea and other African and Middle-Eastern countries (**tinyurl.com/MMnet82j**), which quickly spread across social media. If nothing else, it highlights the importance of not believing everything you read these days (**tinyurl.com/MMnet82k**).

It's now become a recognised fact that, apart from being the bane of any good night out, selfies are actually dangerous – and not just for your self-esteem. A recent report by *Condé Naste Traveller* (**tinyurl.com/MMnet82l**) offered up the interesting stat that more people were killed trying to snap a pic of themselves last year, than we killed by shark attacks, a stat that it dug up in response to a Reuters report on a new Russian selfie safety campaign (**tinyurl.com/MMnet82m**).

Aaaaaaaaaaaaand Finally...

As a PR tactic for new, updated *Peanuts* animated film, **peanutizeme.com** is pretty cool. It allows you to create a version of yourself in the image of the new-style Charlie Brown *et al* in just a few minutes, and the result will stand proudly alongside anyone's *South Park* avatar (**tinyurl.com/MMnet82n**)

.AVWhy?

Videos For Your Eyes... Not Necessarily For Your Brain

The power of a hashtag is that it can create something greater than the sum of its parts. Thus, while any single on of the #15SecondShakespeare videos doing the rounds (**tinyurl.com/MMnet82o**) would be a curious, brief diversion, together they make up a pile of comedy gold featuring some of the UK's best actors and actresses. The central premise – reciting modern pop songs in a style Sir Laurence Olivier would admire – is a slice of genius, but the gusto with which Thesps like Mark Bonnar (**tinyurl.com/MMnet82p**) dive into their lines is what makes this special.



QUICK BITS... Yorkshire's mighty Moors are to be added to Google Street View with some intrepid walkers currently

Caption Competition



This loud young lady was the subject of issue 1380's caption competition. Here's the best of what you came up with:

- **EdP:** "It is supposed to have the new Sorry app on it, but it seems a bit hard of hearing."
- **WyliecoyoteUK:** "I SAID, WHERE'S THE ANY KEY?"
- **Ondrive:** "COME IN WINDOWS XP, YOUR TIME IS UP!!!"
- **Half-a-daily:** "Yes gran, Skype is brilliant... But you really need to turn your hearing aid up a bit"
- **Ondrive:** "Online training for budding coxons is the future"
- **Thomas Turnbull:** "I think my microphone's on the way out"
- **Thomas Turnbull:** "There must be an easier way to do long distance Skype calls."
- **Ondrive:** "OKAY GOOGLE, SEARCH FOR 'BULL-HORN'; on second thoughts... better not."
- **Martin Prince:** "The weekly management conference call occaisionally got a little out of hand."
- **Martin Prince:** "Another unsatisfied Skype customer..."

The pick of the entries this week, though, was EdP with "Voice input is sooo useful in an office environment!", but if you think you're funnier than that, we'd recommend you head over to the 'Other Stuff' section of our forum (**forum.micromart.co.uk**) and say something funny (but not too rude) about the picture below – or email us via **caption@micromart.co.uk**, remembering to ad the issue number to the email title. Ta!



Micro Bit Delayed

Say it ain't so...

Auntie Beeb has said that its BBC Micro Bit project, reimagined for a new generation of schoolkids, is facing delays.

The problem centres around the new Micro Bit's power supply, apparently, and its an issue sufficiently problematic that it means that schools will receive the computer after Christmas. Boo, and indeed, Hiss. A BBC spokesperson wrote in a blog post that the problem only impacted "a few devices in rare and isolated instances." Despite the low numbers, the corporation decided that it still wanted to make sure that the Micro Bit was reliable and robust.

Once these "minor" revisions have been made, we hope that the million units are released as we're as excited as anyone to see the Micro Bit return.

Sharp Selling 8K TV

October date for next stage in visual goodness

With 4K television hardly having set the world alight, it seems a little odd to hear that Sharp is now going to sell an 8K television set this year. Yet, available from October, this new model will provide early adopters 16 times as many pixels as a 1080p high-definition screen can manage.

Do you want one? Then be prepared to pay ¥16m – that's around £86,000. Clearly, this is aimed at broadcasters and big companies at the moment, but it's still an early foray into what may become a possible buying option for consumers in years to come. Come on though, guys. Let's just try to see if consumers are interested in 4K screens before moving to the next level already!

Snippets!

Poker Virus Havoc

Any online poker fans among you? Well, this news isn't great for anyone with even a passing interest in that particular world. A piece of malware is targeting the online poker world by spying on gamers' cards, taking screenshots and sharing that information with the malware's users before they then try to join the game. Obviously armed with the knowledge of what cards everyone on the table is holding, it's an unfair advantage. The malware has reportedly been found in file-sharing programs and PC Utilities – this is a sneaky little thing. It also goes after logins and passwords, too.

Former Fishmonger Makes BAFTA List

The BAFTA Scholarship Scheme has revealed the list of students who will be funded through their games studies. The list of 13 students includes a former fishmonger, which is a big deal to BAFTA for some reason; presumably because it shows the eclectic variety of those involved in gaming? Who knows? Anyway, as well as receiving financial support of up to £10,000, the winners will also receive one-to-one mentoring by BAFTA members and award-winners.

GTA Devs Blast BBC

The BBC's Daniel Radcliffe-fronted drama about the legal battle between the makers of *Grand Theft Auto* and US lawyer Jack Thompson over his attempts to stop the game's release has come under fire… from the game developers themselves. During the first airing of the show, Rockstar's official Twitter feed posted a couple of messages squarely aimed at denouncing the programme for its content. First tweeting "This new *Rentaghost* isn't as good as I remember" it finished off with "Was Basil Brush busy?" followed by some swearing. No further comments has come from either the BBC or Rockstar. Probably for the best, eh?

Konami Gives Up AAA Games, Barring PES?

Snake goes out on a high

If media reports are to be believed, Konami could be looking at giving up future development of AAA console game titles – all apart from its *Pro Evolution Soccer* franchise. The reports seem to have emerged initially from France but, given the breadth of news stories on the matter, it does appear to have some credence behind it – although there has been no official word from the company itself on the matter. Indeed, a few voices from the developer took to Twitter and Reddit to deny that production on console titles had ceased, but no definitive word on the matter from Konami at the time of writing.

What's the truth? Hard to say, although when you have so many media reports running with a story it's hard to think that there is no smoke without fire, so to speak. If the reports are indeed true, Konami's *Metal Gear* series has at least gone out on a high with the latest release in the franchise garnering some highly positive reviews. And, hey, as long as PES keeps going, we're happy.



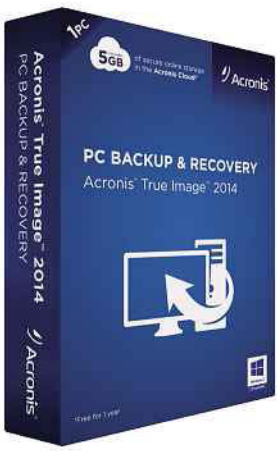
Acronis Warns Families Over Digital Memories

Keep things safe, people

Acronis has released a press note warning that families aren't doing enough to keep their precious digital memories safe and it's saying that people should be backing those digital files up to keep things nice and safe.

Naturally, Acronis wants you to use something like its True Image software in order to do this but whether you want to do that or go with a rival's backup solution, it's good advice all the same. Acronis cites an Ofcom report detailing that 60% of adults own smartphones to take photos rather than cameras and that just 29 percent of adults over 35 back up their digital snaps.

In terms of those among us who do back things up, 52 percent of us save family photos on external hard drives and USB drives instead of online backup in the cloud. Acronis is also suggesting that you carry out multiple device backups to the one place for easy data management, plus use cloud for storage and data archiving.



QUICK BITS... Within a few days of its launch iOS 9 was running on over half of all iPhones and

Skype Shuts Down Across World

Status settings problem causes global outage

On September 21st, Skype users in the UK, Japan and Australia had to do without their daily dose of online chat, because of what Microsoft cited as a problem with the status settings of the service.

The issue meant that people were flagged up as being offline, so they couldn't make any calls even though they were actually online. Not only were they listed as offline, of course, so were their list of contacts so nobody could call anybody.

The problem was eventually fixed, although it took until after midnight on the 22nd for Skype to confirm that everything was tickety-boo. Cue much ire among disgruntled Twitter users.

URL Crashes Google Chrome

Yikes!

So here's a weird flaw that someone has discovered in Google Chrome.

If you click on, type in, or hover over a particular 16-character URL link – **http://a/%%30%30** – the browser will crash. Essentially, Chrome can't cope with the random string of characters and, as a result, it shuts down. The bug, discovered by a security researcher, has apparently been reported to Google.

So, why does it crash? Turns out that it's something to do with old code in Chrome, but it raises concerns that it could be exploited by naughty people,. That could potentially impact on Chrome users aplenty.

Donkey Kong High Score Topped

Twice!

Who among us hasn't played *Donkey Kong*? You may even have your own high score that you're especially proud of. You may have actually preferred *Frogger* – that's your choice.

Anywho, no matter how good you might have been at the game we're not sure how well we'd have fared in the Donkey Kong Online Open event organised by **DonkeyKongForum.com** (a forum dedicated to… oh, forget it). The event was quite the success as the previous world record score for the big monkey's game was smashed twice within hours. Wes Copeland scored 1,170,500 points, only to then be beaten again by the previous reigning champion Robbie Lakeman, scoring 1,172,100. Talk about a tight competition.

If you're in any doubt as to the importance of these events to those taking part, we urge you to seek out the frankly brilliant film documentary *The King of Kong*. Fascinating stuff.

Code With AI2

Sketch (Part 2)

Build an enhanced Android sketching app with David Briddock

Last time we used App Inventor 2 (AI2) to build a sketching app. It took advantage of the flexible canvas component, offered a sliding line width adjustment and cleared the canvas with a shaking action, captured by the accelerometer sensor. However, there was room for improvement. Firstly we could only sketch in a single colour, and should the app be closed or the device turned off the sketch was lost for good. Let's see what we can do about that, then.

Remember, all you need to play along is a Windows/Mac/Linux PC, web browser and Google account. Ideally you'll also have an Android smartphone or tablet for testing.

What We'll Learn

This time we'll introduce the compact spinner component and use it as a colour list container. We'll also perform some logic coding with the if-then-else control blocks.

In addition we'll ensure the sketch can be saved to an image file on the host Android file system. So let's get started.

Starting AI2

In your browser navigate to the AI2 home page (**ai2.appinventor.mit.edu**) and sign in with your Google account. Select the My Projects menu option and choose the project we created last time, namely the one called 'MMSketch'.

We're automatically placed in Designer View mode. Here we can see the Canvas1, HorizontalArrangement1 layout and LineWidth slider components we added to Screen1 last time.

There's nothing we need to modify here in terms of properties, but we do need a few new components.

Adding A Spinner

To provide greater flexibility we'll add colour selection functionality. The component we'll use is a spinner; a neat little control that combines item storage, selection and display. We can the load up a spinner with a list of colour names, and the currently selected item is always shown.

We'll want to add this spinner to the left of the line width slider. If you remember, last time we placed our slider component in a horizontal layout, located at the top of the screen, to be ready for this eventuality.

From the left-hand Palette panel, click on the group called 'User Interface'. Now grab a Spinner component and drop it to the left of the LineWidth component, inside the HorizontalArrangement1. As you do this, a blue bar will appear to indicate its drop position.

With the spinner component selected rename it to 'Colours'.

Spinner Properties

Most of the spinner properties are fine. However, we want to define a list of items, then nominate one of them to be the selected item when the app starts.

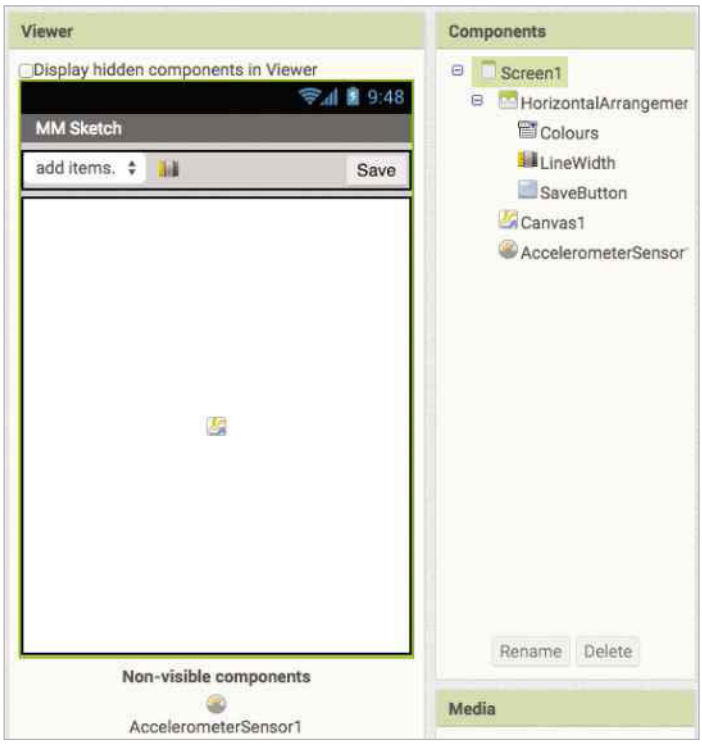
In practice we can define a long list and so create very colourful sketches. But, for the purposes of this relatively short article our list will be constrained to monotone palette of black, white and a couple of greys.

Over in the Properties panel set the ElementsFromString to the comma-separated text string 'Black,DarkGrey,LightGrey,White'. Then set the Selection to 'Black', so that's the default.

Save Button

To initiate the save operation mentioned above we need a button. From the User Interface group grab a Button component, then drop it over to the righthand side of the HorizontalArrangement1, in other words to the right of the LineWidth spinner. Once again a blue bar appears to indicate its drop position.

With the button component selected rename it to 'SaveButton', then over in the Properties panel set the Text to 'Save'.



AI2 designer view

Save Click

It's time to start coding, so click on the Blocks View button located on the green bar.

First let's handle a save button click event. Fortunately, the Canvas component has a SaveAs block, which makes it easy to save our artwork to a file. In the Blocks panel select the SaveButton component, then drag and drop a brown 'when SaveButton.Click' block over to the coding area.

Back in the Blocks panel open the Control group, grab a brown 'evaluate but ignore result' block and snap it inside the brown SaveButton.Click block. Next return to the Blocks panel, select Canvas1 and grab a purple 'call Canvas1.SaveAs' block. Snap it into position at the end of the brown 'evaluate but ignore result' block. You'll notice we need to define the fileName value for the purple block. The file name extension must indicate the file type. In this case it's an image file, so something like 'sketch.png' seems appropriate. However, the filename must also indicate the folder, so we'll specify the root folder with a '/' character prefix.

Grab a simple text value block from the Text group, then set the text string to '/sketch.png' and snap it into position next to the fileName tag.

Spinner Selection

Our spinner already contains a list of colours, so all we need to do is handle a spinner selection change event.

In the Blocks panel select the Colours component, then grab a brown 'when Colours.AfterSelecting' block and drop it into the coding area. Inside we'll add a number of 'if' control statements, one for each spinner list item.

Back in the Blocks panel open the Control group grab a brown 'if then' block and snap it inside. For the 'if' part first snap in a blue Math '=' block. Set the first blue block hole with the number one. Set the second with a light green Colours. SelectionIndex block.

The 'then' part is populated with a green 'set Canvas1. PaintColor' block. Set its value with an appropriate colour block from the Colours group.

Next click the tiny blue button, then drag and drop three additional 'else if' items. Set these in a similar manner to the first 'if' but using the numbers 2, 3 and 4 respectively (see Blocks View image).

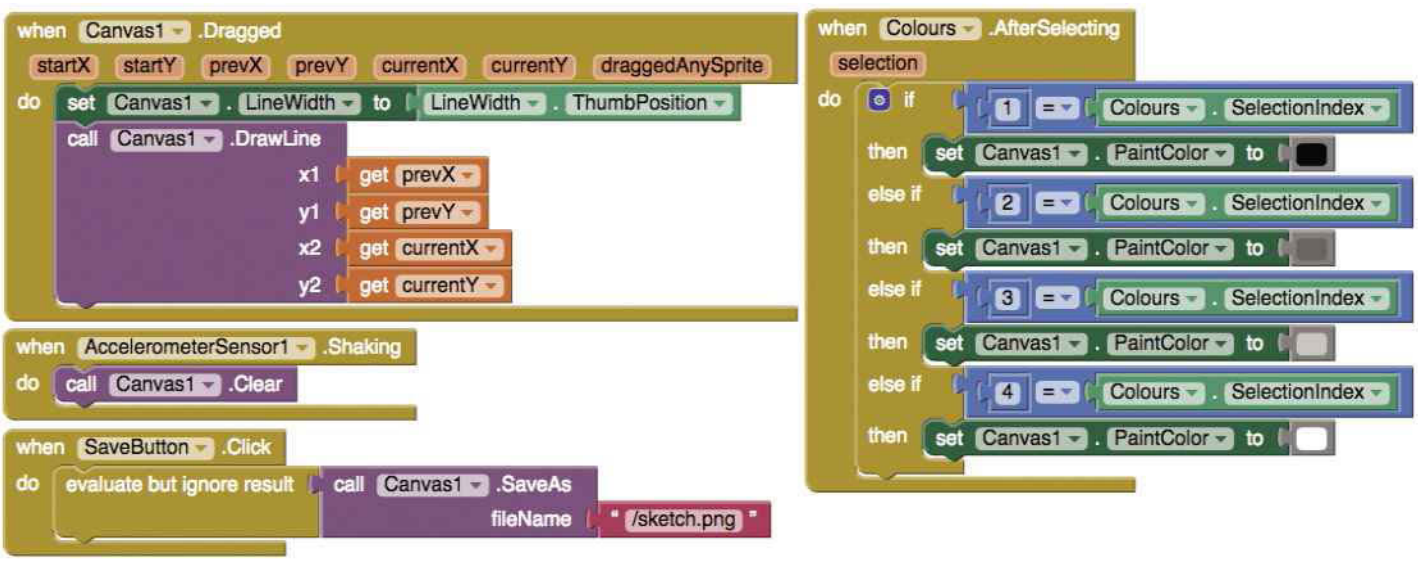
Testing

That's the coding done, then. Ensure the warning and error counts in the bottom left corner are both zero then carefully check your code against the Blocks View image.

Test your app using the AI Companion App installed on an Android device (as we discussed earlier in the series).

Going Further

If you'd prefer a more colourful sketching app feel free to go back into the code and add whatever colours you like to the Colours spinner list. Then simply provide the appropriate 'if' and 'else if' elements for the chosen colours to update the code accordingly. Next time we'll stay with the canvas component to explore animation. **mm**



AI2 blocks view

Acer Revo One RL85

Mark reviews Acer's Revo One RL85, a small powerhouse of potential

DETAILS
- **Price: £649.99**
- **Manufacturer: Acer**
- **Website: www.acer.co.uk**
- **Requirements: HDMI monitor and wired or wireless broadband internet**
- **Part No.T.SYYEK.013**



If anyone can be blamed for the styling of the Acer Revo One RL85, the person I'd accuse is Jonathan Ive, Apple's chief design officer.

It's his obsession with grand design statements that influences others in the tech space to ape everything Apple, even its daftest concepts.

But the difference between Acer and Apple is painted in neon when you first unpack the Revo One and realise that it comes with a remote tracker pad/keyboard, the design of which bears no design continuity with the Revo One at all.

But leaving aside what I think of the outside and how Acer should be ploughing its own furrows, let's look at what's inside this rather expensive obelisk with the corners knocked off.

At its heart, the Revo One is laptop technology repackaged into a tiny desktop computer. Inside the review model (DT.SYYEK.013) is an Intel Core i5-5200U processor, used in the HP Spectre x360 and Dell XPS 13, to mention just a few systems.

There are much less expensive models with a Core i3 or Celeron, but they all use the same basic chassis with integrated GPU and have the same external port selection.

Those include just four USB ports, two of which are USB 3.0, and one is always occupied with the dongle for the trackpad/keyboard.

There's also a gigabit LAN port and both HDMI and mini-DP video outputs. Those last ports are rather critical, because as I got deeper into the RL85, the more relevant to media playback and storage duties this hardware got.

To get access to the internals, a small button on the rear releases most of the plastic shroud and reveals the central frame, on which two 2.5" easily accessible SATA drives are mounted.

The review model had dual 2TB Seagate hybrid drives, and buried deep inside the machine was a 60GB SSD where the OS was installed, leaving the two hybrid drives entirely for data.

Having triple drives does offer the possibility of RAID 5 redundant drive mode, though I'm not sure I'd recommend it on a configuration where one drive can't be swapped out easily.

Lower specified versions come with less storage, and swapping out the two chassis mounted drives is practically the full extent of user customisation.

Acer seems to think that most customers will never venture inside, because it doesn't provide any documentation that outlines doing this or even how to release the covering shroud.

Being curious, I delved. It's an exercise that requires very carefully removing many parts and screws to get to all the interchangeable bits.

Underneath one of the drives I found an access panel that allowed me to swap out the 802.11ac wi-fi module, although that's not a practical way to get the RAM SODIMM module out even if it is socketed.

If the module fails or wants increasing in size, you'll probably need to dismantle

> **"The biggest problem with this hardware has is the price"**

- **Acer Revo One RL85 Specifications**
- **Operating system:** Windows 8.1.
- **CPU:** Intel Core i5 i5-5200U dual-core 2.20GHz.
- **Memory:** 8 GB DDR3L SDRAM.
- **Storage:** 2x 2TB hybrid drives, 60GB SSD.
- **LAN:** Gigabit Ethernet.
- **Wireless LAN:** 802.11a/b/g/n, Bluetooth.
- **Expansion Slots:** 1x mini PCI Express slots (used by wi-fi adapter).
- **Display Output:** HDMI and mini DisplayPort.
- **USB 3.0 Ports:** 2.
- **USB 2.0 Ports:** 2.
- **Maximum power supply wattage:** 65W.
- **Size H/W/D:** 155 x 106.5 x 106.5mm.









the machine entirely. That's an exercise that probably invalidates your warranty I suspect, and it isn't for the faint hearted.

From what I can find, Acer hasn't written a proper manual for the RL85, so there isn't any guidance on what you can do or even what options there are.

To make use of the 8GB of internal RAM, Windows 8.1 64-bit is pre-installed, along with plenty of superfluous Acer-branded apps and the ubiquitous delete-me-first-off McAfee Internet Security.

Luckily for me, the previous reviewer of this device had upgraded it to Windows 10, dispatching much of the crapware, which is an alternative to spending your valuable time systematically deleting it.

In performance terms, there isn't anything special here, as it performs within 5% of what all other i5-5200U-based machines do, which is generally less than the typical speed of a full Core i3 desktop solution. The integrated HD 5500 GPU can play 4K video smoothly if you have a monitor of that quality, but it's never going to win friends and influence people in the gaming world.

The biggest problem with this hardware has is the price, because for this sort of money you can get an almost identical specification laptop that includes a screen, a proper keyboard and some battery life.

If you do want a centralised design like the Revo One for your lounge, then I'd probably recommend the Celeron 2957U model, because it's less than half the cost of this one.

As interesting conceptually as the Revo One appears, Acer doesn't manage to carry this styling exercise off. The remote seems cheap and poorly considered, it's tarred and feathered it with bloatware, and for what's inside the price is way too high.

That's a shame really, because strip away the Apple homage and the cheaply made accessories, and underneath is a great small server or media system trying to get out.

mm Mark Pickavance

Laptop technology repackaged in a small superquadric box



Zotac Zbox CI521 Nano

Zotac installs Intel's new 14nm technology to its Zbox range

DETAILS
- **Price: £279.99 'Barebones' £339 'Plus'**
- **Manufacturer: Zotac**
- **Website: www.zotac.com**
- **Requirements: Mouse, keyboard, OS and monitor**



For those who don't want a big metal box sat next to their desk, there are plenty of options available for smaller computers these days.

One of the biggest ranges come from Zotac, which makes 11 different series of Zbox machines and models that come either as working systems or barebones installations.

The C-Series alone has 19 models, and the CI521 is one of its more powerful, featuring the Intel M-5Y10c processor. This is a new 14nm Core M (Broadwell-Y) class SoC chip, offering dual 800MHz cores that can TurboBoost up to 2GHz while only consuming a measly 4.5 watts.

Using this chip allows the Zbox CI521 Nano to be small, passively cooled, but with enough punch to handle typical home and office tasks with relative ease.

Zotac sent for review the 'Plus' model, which includes a 64GB M.2 SSD and 8GB of RAM pre-installed. The barebones variant will need RAM and storage, although it includes everything else with the exception of an OS.

For those working to a tight budget, there's room in the 125 x 125 x 48mm case for a 2.5" drive instead of using the M.2 option.

Installing an OS will require either an external optical drive or bootable USB media and, as I discovered, you'll also need to go into the BIOS and disable the default mode of entering the EFI shell if a bootable device isn't found.

Once this was fixed, I got Windows 8.x on this machine relatively quickly, and Zotac very thoughtfully provide the drivers on a small USB stick to speed this process along.

I wish more system builders provided software on USB rather than exclusively on disc, because the cost implications must be pennies by now.

After the installation and updates, you end up with is a rather snappy little computer that can be used for surfing or media playback quite effectively. But there are plenty more uses the Zbox CI521 Nano could easily be put to, especially for those looking for an IR remote controlled media player or for a youngster's work platform.

The inclusion of dual gigabit LAN ports also allows this to be easily configured as a hardware firewall with the appropriate Linux distro in place.

In the box, Zotac provides a VESA mounting plate so you can attach the Zbox CI521 Nano to a monitor and create an ad-hoc, all-in-one solution. That doesn't make it very easy to access for ports and the card reader, but it does provide a discrete means of deployment.

What this machine won't do well is run games, because even with Intel's HD 5300 GPU on board, there really isn't the horsepower in the Core M CPU for 1080p 3D gaming. With only 4.5 watts for the system to play with, for both CPU and GPU, that's not a huge surprise.

There also isn't any practical way to address this, because the CPU and its GPU are not socketed, and there are no slots you can use to add any discrete video technology.

We shouldn't be too surprised about this, because for SSF (small form factor) computers, flexibility is largely sacrificed for compactness by definition.

That point aside, this is a well specified machine that is remarkably small and

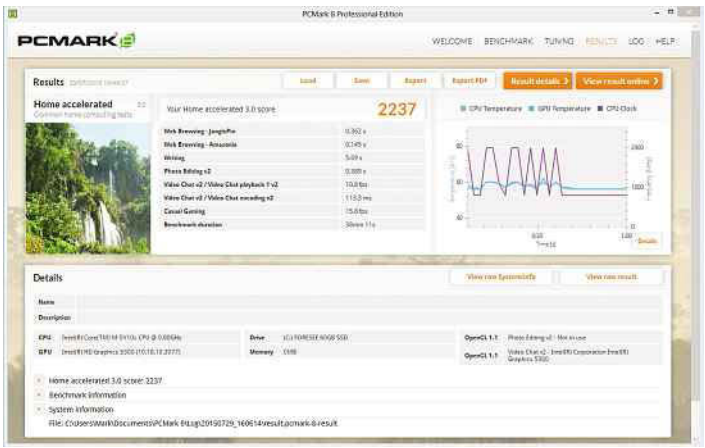
Zotac Zbox CI521 Nano Specifications	
Product Name	ZBOX CI521 Nano PLUS (ZBOX-CI521NANO-P)
CPU	Intel M-5Y10c (dual-core, 800MHz) TurboBoost up to 2GHz
GPU	Intel HD Graphics 5300
Memory	8GB of 1600MHz LPDDR3
LAN	2 x 10/100/1000Mbps
wi-fi	802.11ac + Bluetooth 4.0
Sound	Stereo analogue output Digital 8-ch via HDMI S/PDIF
Storage	60GB M.2 SATA SSD 1 x 2.5"SAT A HDD/SSD bay
Card Reader	3-in-1 (SD/SDHC/SDXC)
Video Outputs	1x HDMI, 1x DisplayPort
USB Ports	4 USB 3.0 (two on back panel, two front)













efficient, all neatly packaged in a stylish, if exclusively plastic, case.

My only real gripe is the price, especially when compared with the recent Intel NUC machine I reviewed a few weeks ago. That offered a barebones design with a Core i5 processor and a metal case for about £300, and a similar Core i3 variant for just £240.

To quickly compare the two, this rig scored a PCMark08 Home score of 2,237, whereas the Core i5 NUC managed 3,014. It's also worth mentioning that the NUC is physically even smaller, although that specific NUC model can't hold a 2.5" drive.

I generally liked the Zotac Zbox CI521 Nano, but the price particularly for the barebones needs to be much lower if it's to compete with what Intel and others are offering.

However, with the minimal difference between the barebones and the Plus, the latter seems generally much better value considering how much M.2 SSDs and LPDDR3 RAM will set you back. In this respect, the £60 difference is certainly worth paying.

mm Mark Pickavance

A small computer with many possible uses



Corsair VOID Stereo Headset

Mark stared into a VOID and heard a distant rumble

DETAILS
- **Price: £63.72 (Ebuyer)**
- **Manufacturer: Corsair**
- **Website: www.corsair.com**
- **Requirements: Hardware with 3.5mm jack audio**







A long time ago, in a distant galaxy, Corsair did only RAM. But these days it's got numerous fingers in multiple pies, ranging from water cooling to SSDs.

One of its expansion areas is gaming gear, and it's made some really nice keyboards and mice for those with time on their hands.

The VOID is a new range of four gaming headsets, targeted at those who want something comfortable to wear at their PC or console, so they don't annoy others who live within a half mile radius.

At the top of the VOID pile is a wireless Dolby 7.1 special edition entitled 'Yellowjacket'. Then the same hardware but less special: a USB connected 7.1 set. And the bottom rung, reviewed here, is the VOID Stereo headset.

The stereo option has a few critical advantages over all the others, the most obvious one being the lowest price. The other is that because this one doesn't use USB, opting instead for micro-jacks, it works with just about any hardware, from a smartphone to a games console.

The cable terminates in a four-pole 3.5mm jack, which a provided converter then splits into two three-pole types, one for the sound and the other for the noise cancelling microphone.

As it's generally considered a good idea, the microphone is on a rotating boom mounted on the left-side can, along with a thumb-wheel volume control and a mic mute. There are no controls on the right side, so you only need to use your left hand to make a change when gaming.

Having used these for a number of prolonged computing combat sessions, I was impressed not only by how relatively light they are, but the balance and ear pads make them very comfortable.

In Corsair's marketing material, much is made of the microfibre-wrapped memory foam ear pads, but in this instance they do actually live up to their billing.

The only aspect of them that could be improved is that they tended (on my head) to leave small gaps for external sound to leak in. That's fine for me, because I don't like being surprised, but if you want total isolation, then it isn't ideal.

One counter to that is the volume these 50mm neodymium drivers can handle, which is substantial. With my PC volume set to maximum, there was no appreciable distortion detectable by these ears.

Overall, in terms of sound reproduction, the VOID is especially good at the mid to low ranges, though it's also not bad in the treble range. There are designs with more bass and treble overall, but not for anywhere near this price.

If I have a valid complaint, it's that the connecting cable is permanently wired into the left-hand side. The might not be desirable, and if the cable is damaged, there isn't any user friendly way to fix it.

Even with that drawback, these are very nice headphones that do what Corsair intended effectively, and they don't cost a fortune for the experience.

mm Mark Pickavance

Specifications
- **Frequency response: 20Hz to 20kHz**
- **Impedance: 32 Ohms @ 1kHz**
- **Sensitivity: 107dB (+/-3dB)**
- **Drivers: 50mm**
- **Connector: 4-pole 3.5mm**
- **Unidirectional noise-cancelling with adjustable, rotating boom microphone**

Affordable gaming headset that delivers acoustically



XFX R7 360 Core Edition

Mark suffers with déjà vu while testing the XFX R7 360

DETAILS
- Price: £88.03 (Scan)
- Manufacturer: XFX
- Website: xfxforce.com
- Requirements: PCIe 3.0 x16 slot, PCIe six-pin power line, Windows XP or later
- Part no. R7-360P-2SF5







When you see the designation R7 360, you might assume it to be 'new'. But the GPU in this card originates from the Bonaire Pro core, now renamed Tobago, which first appeared in the HD 7790 in 2013. Then it took another curtain call in the HD 8770, and then again in the R7 260.

That said, this is a GCN 1.1 specification GPU, and it supports Mantle, Vulkan and DX12. However, its underlying architecture remains unmodified, with the same numbers of transistors, fabrication scale and memory model.

XFX's core edition is the baseline model of its R7 360 model, and it's backed the performance settings off a little, allowing for a smaller card and a single fan cooling system.

It has the mandatory 768 unified shaders, 48 texture units and 16 ROPs, just like the R7 260, and also the same 96GB/s bandwidth using 2GB of quad-pumped 1500MHz GDDR5 on a 128-bit bus.

For those installing it in their system, it needs the ubiquitous x16 slot, a single PCIe six-pin power line, and it can be connected to a DVI, HDMI or DisplayPort monitor. And for those who like multiple displays, this card can support up to four at any one time.

At a snip under £90, the card competes directly with the GTX 750 Ti cards and previous generation AMD R7 260X models.

I'll be honest and admit I didn't do the wide sweep of benchmarks I'd normally do the latest video technology. That's because after half a dozen test results, the penny dropped that I'd seen these numbers before. And sorry to spoil the twist ending, but they were almost identical to the reference R7 260.

There were some exceptions; for whatever reason, the 3DMark Fire Strike Extreme and Ultra tests favour this design, even if they're both still slideshows on this hardware.

I'd contest that in a blind test, two gamers playing on otherwise identical PCs wouldn't be able to separate this and a typical R7 260. That's a bit of a problem, because you can easily pick up an R7 260X that is about 5% quicker more cheaply than this. It does beat the GTX 750 Ti, but that's based on even older GPU technology.

The quandary here is whether you go for this design, as it might have a higher resale value down the road, or go with the tried and trusted R7 260X and save some cash now. That's a tough call.

This card is nicely made and styled, does what is expected of it, and it has enough power to play most games at 1080p with reasonable detail levels.

Also positively, it's very quiet even when under load because of XFX's very efficient Ghost Thermal 3.0 technology in the cooler.

But even with that desirable feature, I find it difficult to argue that it is sufficiently revamped from its predecessor to justify it over an older discounted card.

mm Mark Pickavance

A new name, old specification and familiar benchmark scores



BACtrack Mobile Breathalyser And Detector Keychain

Take responsibility for how much you drink, with this pair of devices

DETAILS
- **Price: £132/£25**
- **Manufacturer: BACtrack**
- **Website: goo.gl/llQbsw**
- **Requirements: iOS, Android, Apple Watch**



The BACtrack Mobile Breathalyser connects to your phone to track your alcohol content over time

The keychain device gives an instant reading of your BAC percentage

Other than being stopped by the police and taking a roadside test, we generally have no way of telling how much alcohol is left in our system. However, thanks to a couple of products from BACtrack, we now can.

There's a fine line between being responsible when drinking and using the technology to, in some ways, cheat the system. Personally speaking, we think that if you're driving, then you shouldn't have anything to drink whatsoever, but some would argue a half-pint is okay. What we have here, though, is a device that can take a person just below the legal limit – if they're irresponsible enough. Then if and when they're stopped, they're under the roadside limit, despite their reflexes and judgement being impaired through alcohol.

BACtrack, though, isn't trying to promote any form of drink driving; it's actually trying to do the opposite. But the potential for abuse of the system is still there. The first of these two products, the BACtrack Mobile Breathalyser, has a police-grade sensor built in that can detect the slightest change in your BAC (blood alcohol content).

There's a miniature internal solenoid breath pump within the 44 x 69 x 16mm plastic body, which weighs just 47g and is perfectly suited for carrying in a pocket or bag, which can ensure the most accurate and efficient means of capturing the person's breath for analysis.

Once your breath test is complete, the smart stuff then comes into play. By connecting the Mobile Breathalyser to your phone via Bluetooth, you're able to view your BAC then and there, or track it over the time that you're drinking.

Also, by personalising the BACtrack app with your age, weight, what you've drunk and its alcohol volume and how much, plus anything you've eaten and the amount of time between drinks, the app can give a good calculation of what your current situation is. Furthermore, it can also calculate, based over time too, when your system is free from alcohol.

It's an easy device to set up and use, with washable mouthpieces and a privacy function to limit the data the app picks up. Connection to a Bluetooth device is simple enough, and once paired it's a fairly quick and painless check of your BAC.

As far as we can tell, the results appeared accurate enough – without having a police officer handy to check us, of course. But as we said, the device and app should be used to monitor your drinking habits, not as an excuse to abuse the system.

The second breathalyser device from BACtrack is a handy keychain example, not much bigger than a car key, measuring 37 x 14 x 62mm and weighing just 56g

This model, instead of being connected to a smart device of some description, displays your current BAC percentage via a small readout on the front of its body.

Again it's a quick and simple device and comes with a single AAA battery, three mouthpieces and a user guide. All you need to do is blow into it for a set time, until the counter hits zero (five seconds), and once the sensor has analysed the result, which doesn't take too long, it'll be presented on the digital readout.

The single AAA is good for about 150 tests, but you have to be careful and leave a good 20 minutes between tests for an accurate reading – and not to damage the delicate sensor.

As before, it's an interesting device and one that we're sure is extremely useful. The example we used earlier, checking someone before they drive you from one location to the next, is an ideal situation for the keychain device. Just tell them what you're doing before attempting to stick the device in their face.

Overall, both BACtrack breathalysers are produced to a very high quality and are well presented throughout. They're easy to use, handy to have on a night out (or a morning after) and when used responsibly can have a great benefit for the user and their friends.

The BACtrack Mobile Breathalyser retails at around £132, though, which is a little expensive. However, the BACtrack keychain detector can be had for as little as £25. Either way, both serve their purpose well.

mm David Hayward

A handy pair of devices, but personal responsibility is still needed



Elements 1K

Michael Fereday checks out a DECT phone designed for outdoor use.

DETAILS
- Price: £63.61 (Amazon.co.uk)
- Manufacturer: BT
- Website: www.bt.com
- Requirements: n.a.



Rather than the cosier atmosphere of inside the home, the BT Elements 1K DECT phone has been designed for rugged environments. While you could use this handset in the living room, the outdoors or a workspace would be more appropriate areas to take advantage of a feature set that includes a dust and waterproof rating of IP67, plus an impressive wireless signal range that could reach one kilometre in ideal circumstances.

My BT Elements 1K kit consists of a single handset with its own docking charging unit, a base station with the telephone line lead already connected, two power leads for the previously mentioned two items, a separate long-range antenna, and screws and plugs for wall-mounting the base station. Both a belt clip and li-ion 3.7V 550mAh battery come already attached to the handset. There's also a two-handset package available from BT.

Rather too bulky for most pockets with dimensions of 195 x 56 x 30mm (H x W x D), hence the belt clip, the handset has a more robust than stylish appearance with its plastic and rubber protected body. A 3 x 3cm monochrome screen, providing status and feedback information, sits on top of a standard arrangement of selection, navigation and alphanumeric telephony keys. Initially covering the screen is a removable label advertising the phone's nuisance call blocking feature – a boon to all of us who needlessly suffer from companies indulging in cold calling activities.

> "Up to 30 minutes of recording space is provided"

Protected by a PIN number, the nuisance call blocking feature offers the users two methods of adding callers to this category. You can block calls by type or by specific numbers. In the case of the former, you can select from categories listed as International, Withheld Numbers, No Caller ID and Payphone. Up to ten specific numbers can also be added to the blocked list, and these will also be denied access to the answerphone facility. Callers selected by type will be allowed to leave a message on the answerphone.

When setting up the answerphone facility, care should be taken to ensure the time delay of number of rings is such that it does not conflict with other available features such as voicemail. While you do get a default welcoming message for callers, you could replace this with one you've recorded yourself. Up to 30 minutes of recording space is provided to those who have access to this feature.

The promised one kilometre range of this device is only going to apply when using the handset outside. Even then, the location will need to be obstruction-free so any signal is not blocked. The replacement long-range antenna will need to be attached in order to get close to the promised distance. Even in less than perfect locations, the range of this product should be better than that offered by other DECT handsets.

Along with the call blocking facility mentioned earlier, this phone lets you create a period of time during which only those on your VIP list such as nearest and dearest, will have their calls accepted. This 'Do not disturb' feature can prove useful for those personal moments that we all need from time to time. Fully charged, you should get ten hours of talk time or 250 hours on standby with this DECT phone.

mm **Michael Fereday**

Suitable DECT handset for those spending time on outdoor activities



GROUP TEST

Small Linux Distros

One of the more amazing aspects of Linux is the fact you can strip it down to its bare necessities and still have a fully working operating system.

These super small Linux distros can be a little niche, but with the right project in place they can really shine.

We take six small distros and see what they're made of and how well they perform for a variety of user skill levels.

Damn Small Linux

DETAILS
- **Price: Free**
- **Manufacturer: Community**
- **Website: goo.gl/mrOnJH**
- **Requirements: 486, 24MB RAM**

Damn Small Linux (DSL) has been around for some time now and was one of the first few really small Linux distros to appear on the scene, with a target size of 50MB or less. Originally developed by John Andrews as an experiment to see just how many usable desktop programs can fit inside a 50MB .iso, this small but perfectly formed example of a space saving Linux distro was used by many a techie who needed a quick but solid boot platform and IT survival kit to work from.

It's based on Knoppix, often regarded as the old man of Linux, and it has successfully managed to strip off all but the essentials. Although this does leave it a little bare, it does still qualify it as what most users would term a modern Linux desktop.

For novice users, DSL is perfectly adequate; it's quick to boot, easy to understand and comes with a few familiar applications – enough to tinker with and bring some life back to that old Pentium you have lying around. For those who are after something a little more niche, such as a recovery distro, DSL won't disappoint there either.

Included within the 50MB are a few recovery packages in the form of Emelfm File Manager (which you can use to access Windows partitions, for example), as well as some remote desktop tools, Word viewers, a PDF viewer, an FTP daemon, a VoIP application and a web browser. In truth, there are a surprising amount of useful applications that come pre-installed, plus you can add your own apps and further customise the initial setup to better suit your own needs, then use DSL as a more personal Linux distro.

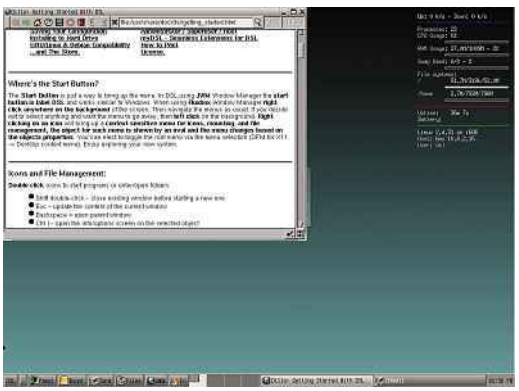
There's nothing wrong with using DSL as your main desktop OS of choice, although to be fair you'll be missing out on some of the more advanced enhancements that a modern distro has to offer. That said, with a little work, DSL would make an excellent OS for a more modest system.

Unfortunately, the stable release, version 4.4.10, hasn't moved on since October 2008. There is an unstable, 4.11 release candidate that was launched in 2012 but, according to sources, there has been a bit of a falling out in the DSL community and, as a result, the project has stagnated, and there's little hope of future development.

This also means that DSL will no doubt carry something of a security risk, with it being so far out of date. However, as it stands, DSL is still one of the most highly regarded of super small Linux distros and is flexible enough for someone to enhance to their own unique requirements.

For basic use and as a file recovery/rescue tool, it makes for an interesting project. If you're after something on a professional basis, then you may want to consider another small distro.

micro mart
5 Quality
6 Value
5 Overall



Damn Small Linux is unfortunately a bit out of date these days



There's still plenty to be had within the build image

Puppy Linux – Slacko 5.7

DETAILS
- **Price: Free**
- **Manufacturer: Community**
- **Website: goo.gl/8PfweU**
- **Requirements: Pentium+, 24MB RAM**

Slacko Puppy 5.7 is built from the new Woof-CE Community Puppy Builder system, which in itself is a forked version of the original Woof build system by the (now retired) Puppy developer Barry Kauler. It's built from Slackware 14.0 binary packages, and it features, depending on the version, either the 3.4.82 kernel or the 3.10.32 PAE kernel.

Puppy Linux has become something of a favourite among the Linux fraternity over the last ten years, although it does still receive a fair amount of grief due to the fact that the default user has root level access. However, it's a simple, flexible and straightforward tiny distro that has an impressive community behind it and which is continually being improved. It's also grown to include a few new versions, using different distro packages. As far as we can tell, though, the Slacko version appears to be the smallest so far, with the latest Tahrpup version taking up 199MB.

For a 161MB .iso, Puppy Slacko contains an incredible number of programs and utilities – far too many to mention here, but suffice to say you're getting a fully functional and fully updated desktop OS for the sake of a few megabytes of space.

Puppy Slacko is blisteringly fast on a modern machine; even on a more modestly specified PC, it's out of gate like a proverbial whippet. With this version, Slacko 5.7, you'll get access to the latest Slackware updates and security fixes via the improved Update Manager. There's graphics support for Nvidia and ATI, many bug fixes, GUI enhancements and a number of themes and desktop extras included.

You'll also enjoy Abiword 2.8.6, mtPaint 3.44.04, Firefox, Gnome Player and a few games. In short, there's more than enough to keep you busy without ever really needing to access the package manager and delve into the wealth of other Slackware programs.

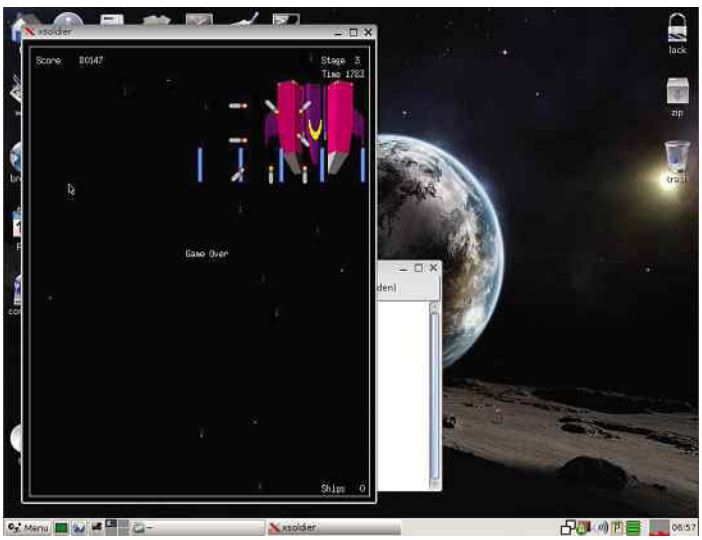
Keeping with the point of view of amateurs and professional users, Puppy Slacko is extremely easy to use, navigate, update and upgrade and does an admirable job at holding the user's hand through some of the more complex aspects of its nature. From the point of view of the professional, Puppy Slacko is extremely flexible, contains all the recent security updates and makes for an ideal system rescue or IT toolkit distro.

Obviously the negatives here are the default users running as root and the rather large and confusing list of Puppy Linux versions that are currently being developed (Slacko, Wary, Racy, Quirky, Precise...). However, a little research will no doubt point you in the right direction, and a little work on the system will solve any of the root level security concerns you may have.

Other than those two lightweight cons mentioned, Puppy Slacko 5.7 turns out to be an excellent, well produced and developed small Linux distro. We particularly liked the fact that you can save your live session to file or CD, allowing you to boot into a more personalised version every time – handy for a network admin, someone who's charge of a desktop roll out or other such duties.



Puppy Linux Slacko 5.7 has some good features



There are also a few games included



Slax

DETAILS
- **Price: Free**
- **Manufacturer: Community**
- **Website: goo.gl/ZywUQX**
- **Requirements: 486, 256MB RAM**

Weighing in at just 210MB, Slax 7.08 Linux is a modern, fast distro that has an impressive following and works like a charm from the first boot.

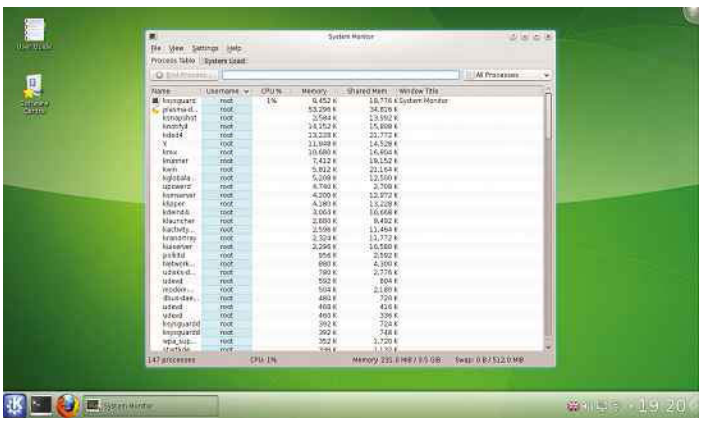
Developed by Tomáš Mat jí ek, Slax is a Slackware derived distro that's ideal for those who require a good working operating system, with plenty of support and a full set of features, tools and utilities. It features a stripped down version of KDE 4, several of the core K-based programs and a unique module-based system to include extra applications. The KDE4 environment is already preconfigured for most of the common tasks, such as data recovery, multimedia playback, instant messaging and browsing the web.

The module system is really quite good. For example, if you wanted to use the live session to incorporate more games than are already packaged, then all you need do is navigate to the Slax web page and copy or download the modules to the /slax/ modules directory on the USB device. Likewise, you can do the same for graphics utilities, multimedia, drivers, networking and so on. Also, you can activate or deactivate the same modules via the Slax Software Centre while running the live environment.

The beauty of Slax is that you don't necessarily have to install



Slax is just an all-round excellent, tiny distro



The slimmed down KDE4 is a delight to work on

> **Slax is more than capable of being the ideal small Linux distro**

it to get the best results. The live environment is more than adequate to cover most aspects of the user base, and if you're running the Slax live session from writable media, such as a USB stick, then thanks to the Persistent Changes feature, any changes you've made to the system will be retained for when you next boot.

This means that Slax is more than capable of being the ideal small Linux distro for both new users and enthusiasts, as well as professionals or those who require their distro to be more of a toolkit rather than something to generally play with.

Another additional quality to Slax is its availability in more than 50 languages, complete with regional keyboard differences and time zones pre-loaded. It may sound like a meagre and over-hyped feature, but how many times have you booted your live environment only to end up having to change the keyboard layout for the umpteenth time? Slax is also available as 32- and 64-bit downloads, with the 32-bit versions said to be capable of running quite happily on something as low as a 486DX with as little as 256MB RAM.

It's actually very difficult to find anything wrong with Slax. It may be the largest of the tiny distros tested, but for just 210MB, you can't really complain too much. Every bit of hardware we threw at it worked perfectly from the off; it was fast to boot (just under 15 seconds); it was a complete, fully working system; and it provided a friendly environment, along with documentation for the user to get used to and work with. The wealth of Slackware packages available is more than enough for any type of user, and getting to them is a straightforward affair.

To conclude, if you need a small Linux distro for whatever purpose, then Slax is definitely the one to go for.



SliTaz 5.0 RC-3

DETAILS
- **Price: Free**
- **Manufacturer: Community**
- **Website: goo.gl/mg70NT**
- **Requirements: 486, 256MB RAM**

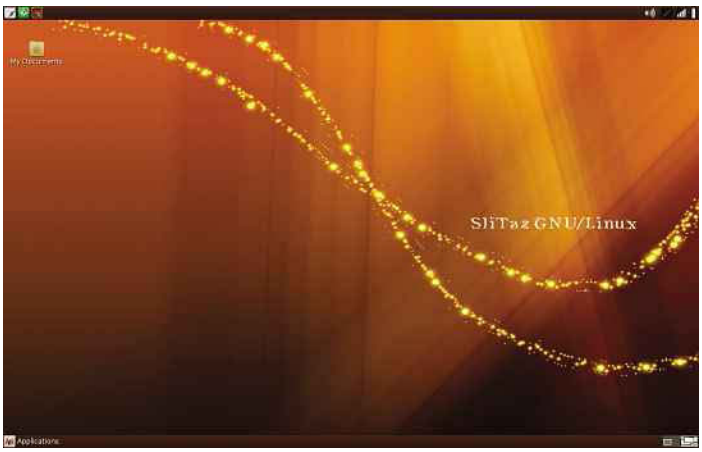
SliTaz appeared on the tiny distro scene in 2008. Developed by Christophe Lincoln, it's a project that aims to create one of the most rewarding desktop experiences with as little system resources used as possible, and it does so rather well.

With an .iso weighing in at just 43MB, SliTaz 5.0 RC-3 is a reliable and stable system with more than 3,000 installable packages within easy reach. To begin with, though, there are a number of included packages such as Midori, TazWeb, mtPaint, Zoho Document Viewer, a SQLite SQL Engine, some development code editors and various music players. Plus you get a wealth of documentation and manuals to browse through, as well as many system tools and utilities.

To say it's a fully functional desktop operating system from the word go would be a bit of a falsehood. Although there are plenty of programs available, you'll struggle to achieve your daily desktop duties without having to resort to the package manager. However, as it stands, SliTaz is pretty good and provides the user with a nice desktop environment based on LXDE and Openbox, and there's even an ARM-based Raspberry Pi version available.



SliTaz is surprisingly good, but you're locked to its repos



It's quite configurable, though, and friendly enough

> **More experienced users may find SliTaz a little limiting**

The new user will certainly enjoy SliTaz, as it's fairly self explanatory with clearly labelled icons, menus and programs, plus there's a huge amount of included documentation that will lead you by the hand through installation to the hard drive from a live session, as well as how to install new packages and solve any problems that may crop up.

More experienced users may find SliTaz a little limiting, though. By that we mean you're bound and limited to the SliTaz custom developed packages from the SliTaz repositories. While there's generally nothing wrong with that, if you're after something particular, then you may struggle to find it or an alternative from the repo – unless you can code your own package. To be fair, though, the package would have to be pretty niche not to appear in the SliTaz repos.

SliTaz is quite a surprising little distro in that it looks okay, is easy to manipulate and configure and is very friendly in its approach to new users. It'll run on any modern machine, and although we didn't have one to test this on, according to rumour, it will work perfectly well on a 486DX4, with just a few hundred megabytes of memory available.

Provided you don't mind being tied to the custom packages, SliTaz does an excellent job of cramming a good, working operating system into an incredibly small amount of space. It's certainly a distro worth looking at and experimenting with.



Tiny Core 6.4 CorePlus

DETAILS
- **Price: Free**
- **Manufacturer: Tiny Core Team**
- **Website: goo.gl/Hknnpl**
- **Requirements: 486, Pentium+, 46MB RAM**

Tiny Core Linux is quite possibly the smallest Linux distro ever devised. Of the three versions available we have Core, which comes in at just 10MB, Tiny Core at 15MB and the one we're testing here, CorePlus, at 86MB.

Obviously, for a 10MB distro, you're not going to be getting a huge amount of software or fancy desktops. In fact, with the Core, it's simple a bootable command line to work with. While this is more than enough for an expert, most of the interested users out there will no doubt struggle to begin with, so the next version up, Tiny Core, will more likely cater for their needs, with the inclusion of X extensions for a decent and functional GUI.

The CorePlus version goes even further and provides a choice of seven window managers and access to the App Browser package manager, as well as full network support for wired and wireless networks (although we did have some trouble getting a USB Netgear wireless dongle working during tests).

Tiny Core was created in 2008 by Damn Small Linux developer Robert Shingledecker, hence the same goal in mind to get as much of an operating system in as little space as possible. Unfortunately, this means that, even with the larger Core Plus version, you'll boot into one of the chosen desktop environments and end up looking at a pretty sparse space. Fortunately, though, with the App Browser you have full access to a large repository of TCZ packages, where just about every conceivable program is available to download and install, with the dependencies being taken care of automatically.

With this in mind and from the point of view of new users or amateur distro hoppers, there's a considerable amount of effort involved in getting Tiny Core up to desktop operating system standards. However, if you're more of an expert or you have a particular use earmarked for Tiny Core, then you can easily build a working and fully functional desktop within minutes and still keep it under the magical 100MB mark. Nevertheless, Tiny Core, no matter the version, is just the barebones to begin with.

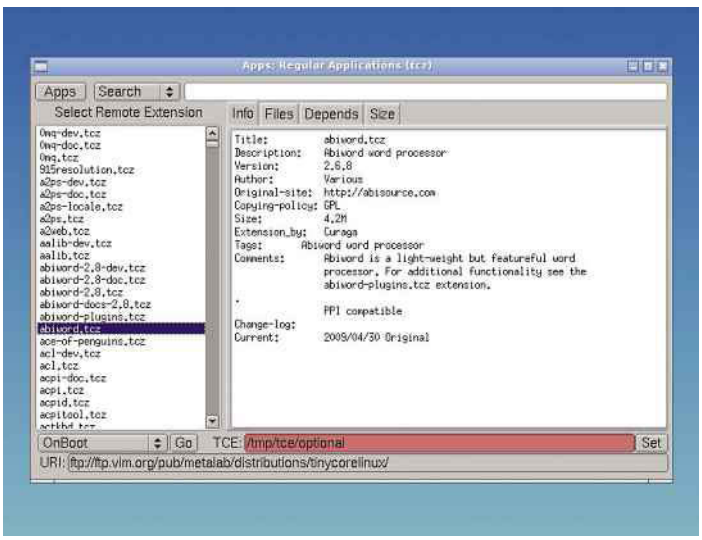
Being as stripped to the bone as is possible means that Tiny Core is a fast OS – very fast. We went from boot to desktop in less than seven seconds, which is pretty impressive. This inevitably means there's a lot of opportunity for Tiny Core to become something more than just another super small distro.

The only negative aspect is the fact you start with no idea of where to go next. For a new user, perhaps a start-up text box detailing what and where to click in order to get hold of some more applications would be handy. Similarly, better labelling of the program icons would also help someone who's new to get started.

On the whole, though, despite the effort taken to get Tiny Core into shape, this is a very fine distro and one that could certainly be incorporated into some interesting lightweight projects.



Tiny Core is a pretty bleak environment to begin with



It can be upgraded, though, to include everything you'll normally need

> **"We went from boot to desktop in less than seven seconds"**

micro mart
6 Quality
7 Value
6 Overall

Porteus 64-bit

DETAILS
- **Price: Free**
- **Manufacturer: Porteus Team**
- **Website: goo.gl/7lqBaj**
- **Requirements: 1.2GHz system, 512MB RAM**

Porteus is an interesting small Linux project that's designed to be both as personalised as possible, while still trying to squeeze in a workable desktop in under 300MB.

This fork of Slax is one of the heavyweights of the group, with the version we're testing coming in at 290MB. However, there's a lot more going on with this distro than what you'd expect from other smaller examples.

To begin with, Porteus differs from the more traditional .iso download, in that you have the opportunity to build the base environment yourself using the online wizard.

To begin with, you'll choose your system architecture (either 32 or 64-bit), followed by the system type (EFI or default) and whether you want to boot to a GUI or command console. After that, you have a choice of desktop environments: KDE4, LXQt, MATE or XFCE.

The next section involves the locale and other personalised desktop settings. You can choose your timezone and keyboard layout, even the default sound volume from the basic options available. By digging further into the Advanced Options, however, you can opt to enable or disable FSCK, RAMSIZE, ZRAM, CLIEXEC and GUIEXEC and whether you want to auto-log-in as the root or as a guest user – with the option to set the root password.

The list of options goes on, with included modules such as a web browser, word processor and so on. And you'll even have the option to choose specific Nvidia, ATI or open source drivers for your graphics.

Once you've run through the wizard, you'll be given a rough final size of the distro, and you can click the link to start building and downloading it.

The result is a distro that you've had some hand in building, which will therefore be a more personal environment than the default, universal versions of other distros. Naturally, it'll still need some work to become fully personalised, but from the point of view of someone who's testing the small Linux distro waters, it's certainly a good start.

Porteus operated perfectly fine under our scrutiny. It booted relatively quickly, was easily updated and maintained, and you can include extra packages using the heavily modified Linux-Live scripts and module files – the same way as with its parent distro, Slax.

For the beginner, it's a good place to start and will provide you with an easy interface to get to grips with Linux without too much hassle. More advanced users may have some use from the choice of desktop environments and the package modules on offer, but they will more than likely opt instead for one of the other universal distros, as opposed to the modular makeup of Porteus.



As a fork of Slax, Porteus works extremely well



It's certainly a good start for a new small Linux distro user

> **"An easy interface to get to grips with Linux without too much hassle"**







Slax

Slax incorporates something for everyone. It's fast to boot, has loads of core applications, looks good and is a fully working desktop.

There are also plenty more packages to install and the module system works a treat.





Puppy Linux - Slacko 5.7

Puppy Linux was a close second, with Porteus coming in close behind. On its own, Puppy is still going strong and is an impressive small Linux distro that's perfect for a number of duties and projects.

How We Tested

We ran each distro as a live environment from both a HyperV setup within Windows 10 and on an aging dual-core Dell laptop with 2GB of memory. In most cases, we opted for the 64-bit version of the OS and the GUI build over command line.

Distro	Damn Small Linux	Puppy Linux	Slax	SliTaz	Tiny Core - CorePlus	Porteus 64-bit
Version	4.4.10	Slacko 5.7	7.08	5.0 RC-3	6.4	3.1
Image Size	50MB	161MB	210MB	43MB	10, 15, 86MB	290MB
GUI	Yes	Yes	Yes	Yes	Yes, Tiny Core and CorePlus	Yes, choice of four
Ease Of Use	Easy to use and understand	Easy to use, but different versions can confuse	Very easy, lots of documentation available	Very easy, lots of documentation available	Okay, some work and effort needed	Very easy, decent documentation, personalised environment to start with
Boot To Desktop Speed	~10 Seconds	~10 Seconds	~15 Seconds	~15 Seconds	~10 Seconds	~15 Seconds

Your Letters

Workshop

After years of sterling service, the PC in my garden workshop finally died, so it was time to find a replacement. When I searched on eBay, while there are plenty of ex-office machines available cheaply, I noticed that servers and server components sell for remarkably little money, and being naturally tight with money, except when it comes to cars, this seemed to be an interesting and economical route to take.

To that end, I ordered a Hewlett-Packard DL140 server for the princely sum of £25 including delivery. The unit came with two 80GB hard drives, 4GB of memory and an optical drive. The plan was to replace the slow, two-core processor with a faster quad-core and fit a sound card. Job done, so I thought.

How wrong can you be? The first, minor problem became apparent when I powered the unit up. The noise was absolutely unbearable. Opening the case revealed no less than eight 40mm fans screaming their heads off. Still, this was a problem that would not be too hard to solve.

However, much worse was to come. I replaced the processor with the Xeon5440 that I had purchased at the same time as the server, only to be greeted with the message at start-up: "unsupported processor". I had already checked on the Hewlett-Packard website that the processor was supported, but a BIOS update was required. Unfortunately, further investigation revealed that the only way to download a BIOS update from Hewlett-Packard was to sign up for an expensive service agreement. Lesson number one: if you intend to buy Hewlett-Packard, make sure that the latest BIOS has been installed before you buy.

At this juncture, the sensible course of action would be to salvage any usable components from the server and scrap the rest, but having got the bit between my teeth I could not bring myself to give up and admit defeat so, having first checked that BIOS updates were freely available, I ordered an Intel S5000PALR server motherboard from eBay for £20. Fortunately, the power supply, memory and drives were all compatible with the Intel board, and the latest BIOS had already been installed. Unfortunately, that was the good news; the bad news was that the motherboard would not fit in the HP case, a problem I could deal with later. But more crucially, the HP heatsink fouled on the rows of capacitors that run either side of the processor socket.

Lesson number two: do not expect server parts to be interchangeable in the way that consumer components are. While any socket 775 cooler will fit virtually any socket 775 motherboard, the same is not true for socket 771.

After some research, the very helpful chap at Akasa technical support sent me a dimensioned drawing of their AK-388 socket 771 heatsink that confirmed that it would fit the Intel motherboard. The heatsink was duly ordered, and in the meantime I lashed an old socket A heatsink to the processor with cable ties and leant a case fan up against it for test purposes. Success at last! The system booted up, I was able to make changes in BIOS and was able to install Windows 7 without a hitch. To my surprise, Windows loaded all the necessary drivers, and as server boards generally do not have sound on-board, a cheap PCIe sound card completed the job.

Procuring a suitable case was going to be tricky and probably expensive and, as this system was going to live in what is probably the scruffiest workshop in England, I decided to construct a simple structure from MDF to hold all the components in their appropriate places. Not elegant but effective.

The final issue was that of cooling. Having built many PCs over the years, I have learned that, with the exception of heavyweight gaming rigs, the CPU cooler and power supply fan are normally sufficient to keep temperatures under control. However, server components are designed with the expectation that extensive forced air cooling will be available, so to that end I suspended a couple of case fans above the motherboard to cool the memory, memory controller and chipset heatsink.

In conclusion, this was an interesting exercise in problem solving although, as it ended up costing me around £100, it was not the economical PC I had hoped it would be. Looking on the bright side, as there's a second processor socket and four empty memory slots, should I ever require it, I could upgrade to eight cores and 8GB of memory for less than £40, which would be a bargain.

Mike Howard

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The Download Directory



James Hunt scours the internet for the best freeware, shareware and paid-for application releases

This month, The Download Directory's collection of offbeat and largely unexplored applications includes Iperius Backup Free, a program for creating and managing file archives; NetBalancer, a network connection managing and balancing tool; DiskSavvy, a program that helps you analyse your hard drive for optimisation purposes; LastActivityView, an activity-log for Windows that works restrospectively; and RogueKiller, which allows you to quickly detect malicious processes.

Iperius Backup Free

Release Type: Freeware
Official Site: www.entersrl.it

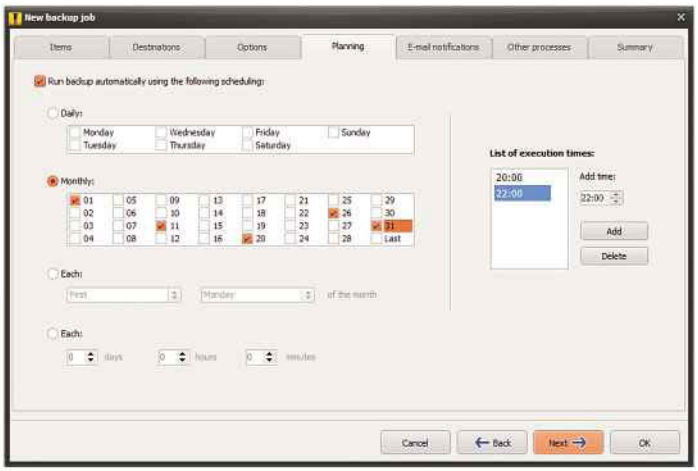
Free backup programs are ten a penny, so if one wants to stand out, it has to do something really different or interesting. Iperius Backup Free tries to do this by being both very configurable and very simple all at once.

You only have to look at the interface to see this is a program that likes to get out of its own way. It looks almost minimalist, with a limited number of options and menus. Everything you need to do with it can be accomplished by clicking just a few buttons, and there's no danger you won't understand the options, because it's all largely self-explanatory.

The program's configurable nature mostly takes the shape of tick-boxes and lists, and other simple to understand items. You can include and exclude certain folders, and a powerful scheduler allows you to run tasks on certain days, at certain times, after a specific interval, right down to considerably more complex instructions like 'the third Wednesday of every month', if that's what you want. It'll also send an email when its task is complete, if you like, and you can make it run other programs before and after backup jobs have completed if that'll help your process.

The free version does have some restrictions, most of which are quite arbitrary. The biggest one is that it can't copy locked or open files, and simply skips over them instead (whereas the paid version doesn't). The free version also lacks the ability to create a Disaster Recovery image, so if your hard drive dies, you won't be able to use backups to create an exact duplicate – only duplicate the files you've backed up.

Despite this, it's simple, powerful and pretty effective in a number of ways. We're not sure it completely outclasses the competition, but it's hard not to find it useful once you dive in, and the interface is certainly working in its favour. If you know someone who prefers more visual options to text ones, maybe it'll help them manage their own backups.



But it's good at what it does, and what it does is necessary enough that you might as well choose this over any other program, at least until you can be sure what you do and don't want in a backup suite. We can't find anything actively awful to complain about, and that in itself is promising enough.

Pros: Does its job cleanly and effectively.
Cons: Does it really stand out? We're not certain it does.
Rating: 4/5

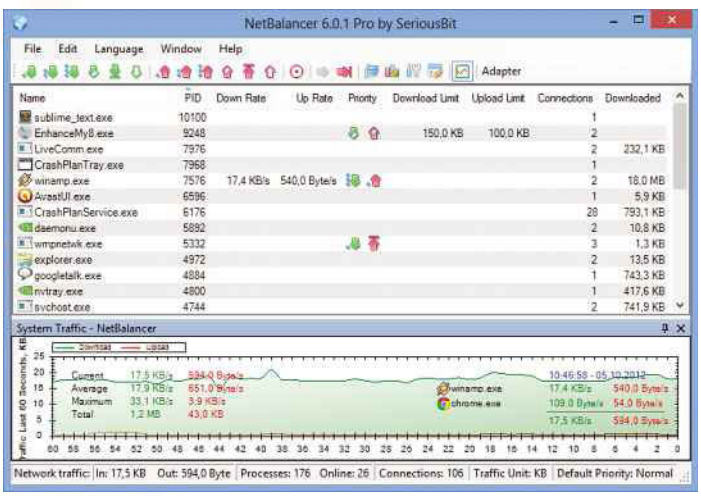
NetBalancer 6.0.1

Release Type: Shareware
Official Site: seriousbit.com

One of the problems with downloading large amounts of data is that sometimes, the process eats so much bandwidth, there's no way for you to use your connection for anything else. In Windows, every program seems to have maximum connection greed by default, so if you're trying to manage downloads in a nuanced way, you're quite simply out of luck.

NetBalancer tries to rectify that by allowing you to set upload and download priorities for every individual application. You could, therefore, make sure your FTP program or email gets the bulk of the bandwidth whenever it's operating, so you know your more important files won't be delayed by any frivolous internet use. You can even completely disable internet access, which is useful not just for cutting off data hogs, but for running security checks too, by denying access to programs that shouldn't really need it anyway and seeing what happens.

It even doubles (triples?) as a bandwidth monitor, allowing you to look at any processes that are running and drawing their network activity on a graph, so if your connection seems suspiciously active



or slow, you can find out which program is trying to contact its mothership. This is particularly helpful in identifying malware, because you'll be able to see when processes that definitely shouldn't be accessing the internet are doing so.

One of the only problems with the software is its business model. As a shareware program, you have to pay to unlock the full version, and the free one doesn't let you control more than three programs at once, which isn't really enough. Casual users can probably make do, but we think anyone who finds it useful will need to upgrade to NetBalancer Pro ($29.95) before too long. Maybe that's the point.

Although it might initially seem quite a daunting prospect, with its graphs and numbers and columns of data, NetBalancer is actually just simple enough for most users to understand, while being complex enough for more advanced users to find it helps them really dig in deep. In a way, it's a mystery that Windows doesn't have its own version of this, but NetBalancer's existence is enough to stop us being too upset by that.

Pros: Versatile and insightful software.
Cons: Shareware restrictions are a little too heavy handed.
Rating: 4/5

DiskSavvy 7.8.16

Release Type: Freeware
Official Site: www.disksavvy.com/downloads.html

Windows (and, to be fair, other software packages) can be adept at hiding the amount of space they use, whether by tucking files away in shared directories or spreading themselves out over your hard drive. If space is becoming limited, finding out where your space is being used is a good way to start clearing out the most data-hungry segments of your system. And DiskSavvy is the tool that promises to help you do that.

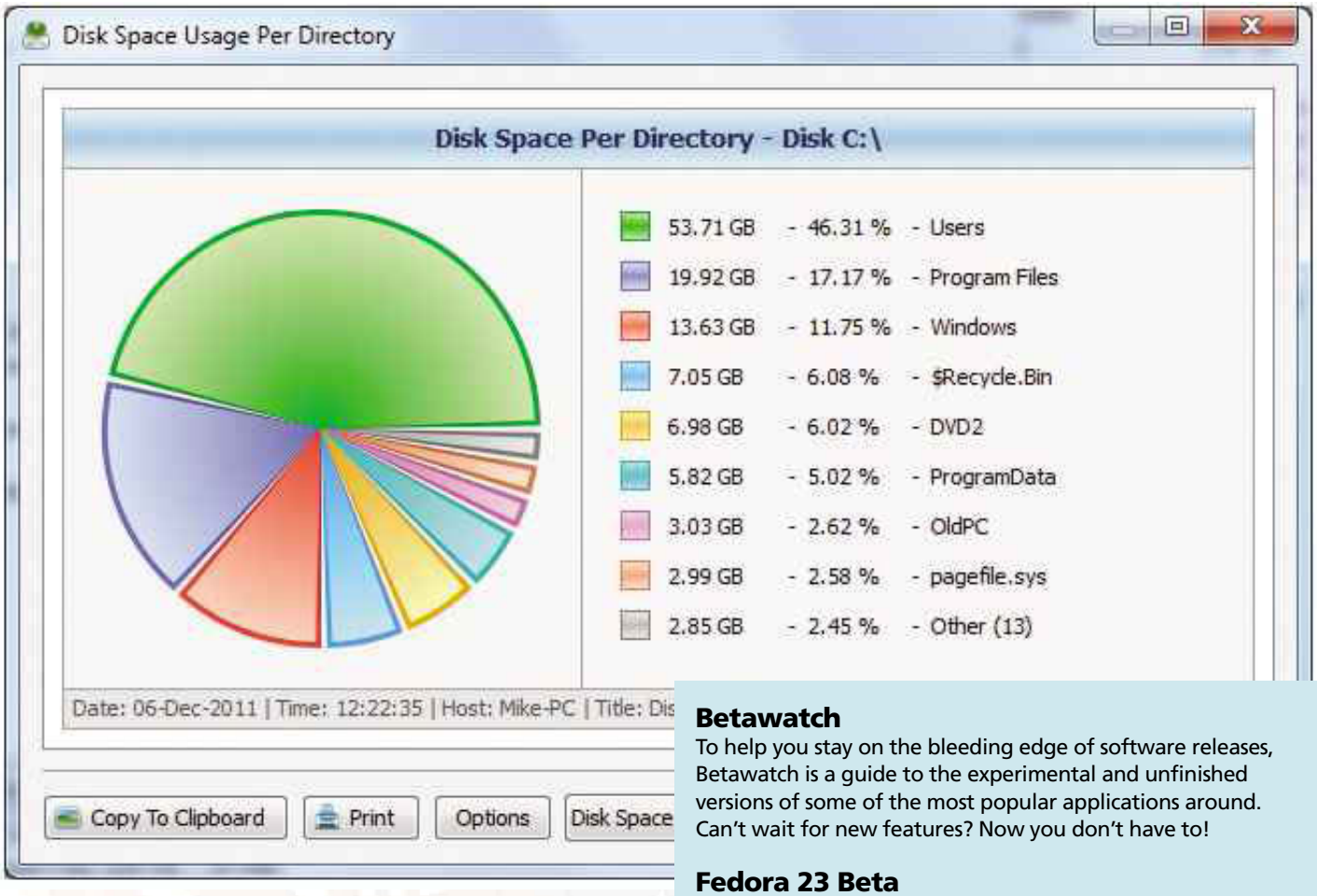
Once you load the program, you simply click the 'analyse' button, then select what sort of breakdown you're interested in seeing, and then the program starts displaying results instantly. This is particularly useful, because it means you can act on information as soon as it's available, rather than waiting for a lengthy process to spit out the data in a single chunk.

The standard results show you exactly which folders are taking up space, so you can go and hunt for outliers. Once you see which is taking up the most space, you can double-click it to drill down and see the breakdown for that particular folder. The visual interface makes it hugely simple to deal with, and users of all abilities will have no trouble finding the folders that are taking up space.

It's also possible to organise the data by file type or extension, so you can see if your media libraries are to blame, while a further option allows you to break it down by file size so you can learn if your space problems are down to a lot of small files or one really big one. Reports can break the options down by creation date, modification date, even access time – and when you've decided where the culprits lie, DiskSavvy will also help you delete the files you don't want.

The latest version includes the ability to export all the data you've collected to an SQL database of an XML file, so if you know what you're doing it's possible to get some really powerful statistics out of your analysis – which is good, because it takes a long time to gather it all. If we had to ask for more, we'd say the program would benefit from being sped up in some way, even though that's probably not possible. But again, that's just being picky – for the most part, it's a great piece of software and one we'd be happy to use and recommend.

Pros: Superb visual interface makes understanding results simple.
Cons: Takes a long time to perform analysis (though understandably so).
Rating: 5/5



LastActivityView 1.09

Release Type: Freeware
Official Site: www.nirsoft.net/utils/computer_activity_view.html

If you share your computer with others (or allow someone else to use it temporarily), you might always be struck with the paranoia of whether they've been going through your stuff without your authorisation. Whether that's fair or not is debatable, but it turns out that Windows contains the data you need to make sure whether your concerns are genuine or not – and LastActivityView, from the freeware geniuses at Nirsoft, will help you get at it.

The tool itself works on most versions of Windows, from Windows 2000 right up to Windows 10, and gives you access to a record of hundreds of small actions – files that have been opened and saved, folders you've viewed, when your system start-up and shutdown occurred, even which programs have recently crashed. It's almost unnerving how deep a record of your activity Windows can give out if it's nudged in that direction!

As well as paranoia and security purposes, the program has a certain level of tech support value. If someone insists that they haven't changed any relevant settings or opened any malicious programs, you now have a tool that will allow you to make sure of that. Even if they don't understand what they've done, you'll be able to.

All that said, there are limitations to the program that prevent it from being a more serious security or analysis tool. It only logs activity performed through genuine Windows controls, for instance, so a third-party hijack might not show up. System cleaning tools can easily wipe the logs it draws on to display its information too. And changes to the clock will misorder the tasks as they're performed, so it's not hard to hide activity if you know it's likely to be spotted.

Betawatch

To help you stay on the bleeding edge of software releases, Betawatch is a guide to the experimental and unfinished versions of some of the most popular applications around. Can't wait for new features? Now you don't have to!

Fedora 23 Beta

getfedora.org/en/workstation/prerelease

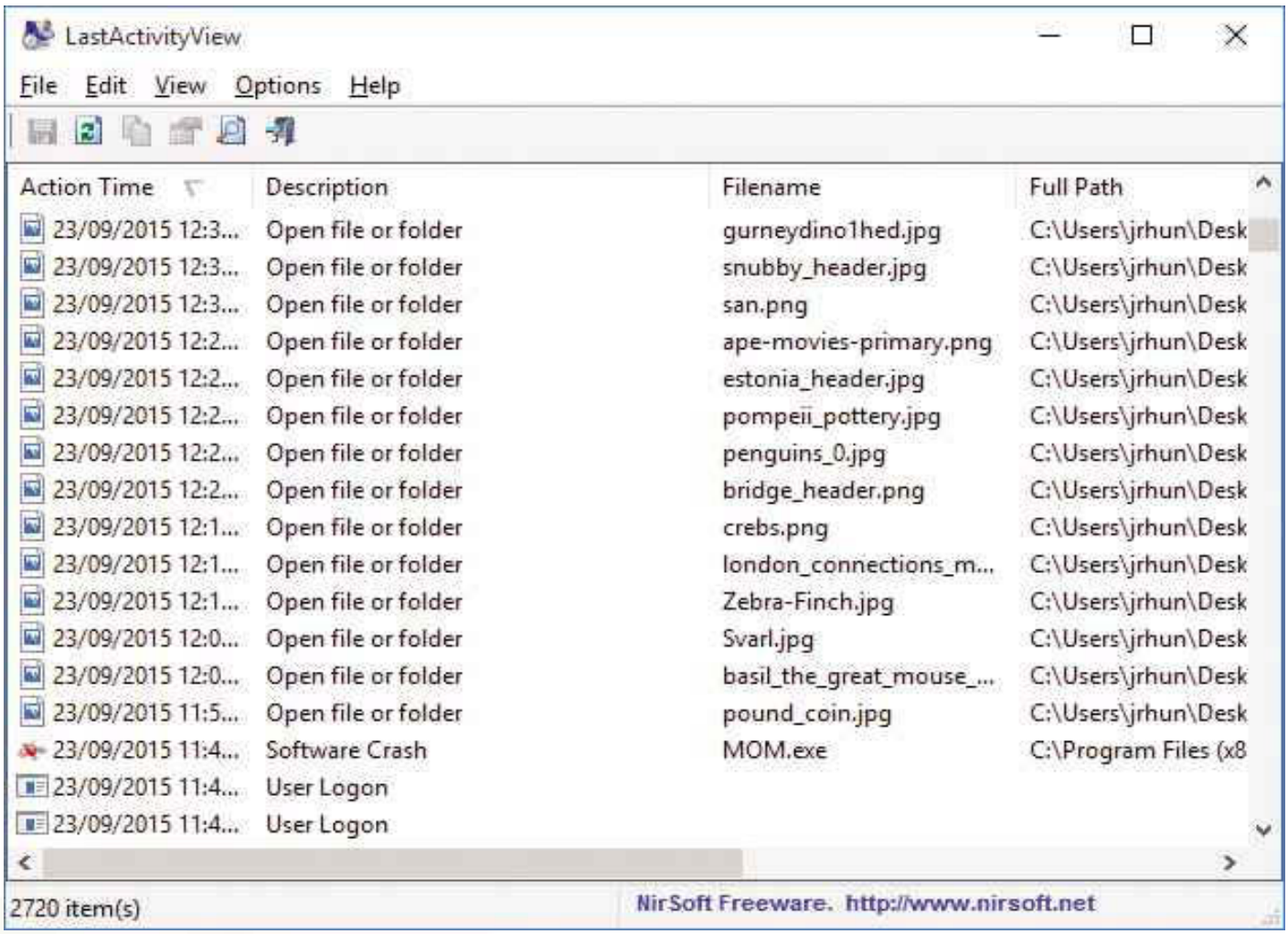
If you use or are interested in using Linux, you may be interested to hear about the beta prerelease version of Fedora 23, which is currently available for download from the above URL.

Changes that have been made to the overall operating system include more robust security, from defence against memory errors and overflow exploits to the complete disabling of SSL3 and RC4 protocols after vulnerabilities were discovered.

Fedora 23 also comes with a new version of Mono (v4), marking a long-awaited upgrade from the aging version 2.10 included in previous packages. Mono is a cross-platform development environment, which usefully allows applications to access .NET functionality on Linux. The OS also adds support for Unicode 8.0, including new emojis and the ability to process non-ASCII URLs.

Those installing the Workstation (desktop) version of Fedora 23 can also look forward to a previous of Gnome 3.18, and a huge number of enhancements including a new graphics stack with better HiDPI monitor support, compatibility with ambient backlight drivers for laptops and monitors that support the feature, better awareness of metered internet connections, refreshed support for Google APIs (including Google Drive integration) and the inclusion of LibreOffice 5.

Fedora 23 is available now, and like all Linux installations, it can be installed free on any system. These extra features mean there's no better time to try it out than now – except, arguably, when the final release of Fedora 23 comes out at the end of October.



ReDownloaded

This month, in our regular retrospective section, we're looking back at the October 2013 instalment of Download Directory to see how the programs we reviewed have fared. Are they better? Worse? Gone completely? Here, we find out.

RAMMon

www.passmark.com/products/rammon.htm
Reviewed Version: 1.0, Current Version: 1.0

We liked everything about this freeware, ultra-simple RAM-monitoring program, with the sole criticism that it wasn't portable. Two years on, literally nothing has changed. It's still as useful as ever, so it's easy to forgive the fact that it hasn't updated, but at the same time it's not the most encouraging thing to see in any software development. As it is, this is a rare example of a program that was probably as good as it could have been the first time around, so we won't criticise it too much for not making any changes.

UniPDF

unipdf.com
Reviewed Version: 1.0.5, Current Version: 1.2

Although it seems to have changed hands (the original download site no longer mentions the software), UniPDF (a PDF decompiler) is still around and still free. Feature updates are virtually non-existent, though; all of the updates seem to have involved adding language support and fixing minor bugs, and they're all from a long time ago. It still works, and it's too early to say it's been abandoned by its developer, but this is one case where the program needed a lot more work than it's received.

DropIt Portable

sourceforge.net/projects/dropit
Reviewed Version: 5.3.2, Current Version: 8.1.2

Now this is more like it. DropIt is a rules-based file organiser that you can configure in a huge number of ways so you can drag and drop any files onto the program and watch it automatically organise and rename them for you. We gave it a full 5/5 rating back in the day and its updates and feature additions mean we'd rate it higher now, if we could. Definitely worth a look – more so now than ever.

LogMeIn Free

secure.logmein.com/UK
Reviewed Version: 4.1, Current Version: n/a

This remote administration and screen-sharing program was top of its class by some distance in 2013, which is probably why its owner discontinued the free version shortly after we reviewed it. These days, you have to pay a hefty amount to use the pro versions, and frankly it's too much for the home users that LogMeIn Free would have been courting. A sad outcome for free software fans, but luckily you don't have to look far to find workable alternatives.



Despite this, it's not a bad tool and far less intrusive than installing a larger activity tracker or keylogger in an attempt to see what someone else is doing on your (or their) machine – not least because it works retrospectively. Ultimately, it's a well-made program, but its uses are moderate. It's not the perfect tool for many jobs, other than being the perfect way to see if you need something more complicated for next time. Perhaps its greatest reason for existing is to show you just how much your computer can reveal about what you do and when – and we suspect that to many people, that would be far more concerning than the program is useful!

Pros: Quick, easy access to helpful data.
Cons: Not quite powerful enough to do anything with that data.
Rating: 3/5

RogueKiller 10.10.6

Release Type: Freeware
Official Site: www.adlice.com/software/roguekiller

The computer security industry is competitive, and that means if you're going to maintain a program that purports to be part of it, you have to make sure you're really playing with the big guys. Unfortunately for RogueKiller, it hasn't quite got that memo.

The tool itself has noble enough aims: to help you detect and remove malware from your system. Rather than rely on virus definitions, which are useless against new attacks, RogueKiller uses a kind of heuristic analysis that can detect threats that haven't been formally identified. The problem is that it also detects threats that manifestly don't exist. Almost every time we tried it, completely harmless programs were cut down in its overzealous attempt to terminate malware, on the flimsy basis that they looked a bit suspicious.

If this was an isolated problem, we might be able to look past it, but the registry scan is just as rife with false alarms. Were it not for the fact that the program seems to be quite genuine in many ways, you'd almost think it was deliberate. As it is, it just seems a bit amateurish.

If you're an advanced enough user, you'll be able to spot these false alarms and separate them from the genuine (or at least, potentially genuine) threats. But isn't that what a security program is supposed to do anyway? There's useful information in here about start-up programs, HOSTS files and proxy settings, but at the same time it's hard to trust RogueKiller in light of the mistakes it makes. It's inaccurate enough that its analysis is rendered nearly worthless.

Perhaps the greatest of its sins is that it doesn't even wait for you to approve the closure of a process before it shuts it down, so running it at the wrong time could result in the kind of lost data disasters we don't even want to think about. In light of that, we can't recommend you even try it out. It's just too risky. A shame, because the developer seems genuinely enthusiastic about the work it's put into it, but as users, we can only care about the results, and they're not good.

Pros: It's trying very hard.
Cons: Too inaccurate to trust.
Rating: 1/5

So there you have it! A fantastic collection of programs this month, all of which earned the high ratings they deserve. Remember, if you have any programs that you'd like to see us look at – whether it's something you want to find, something you like and want to share, or even a program you've written and want us to review – don't hang around. Get in touch, and we'll make sure it ends up in the download directories everywhere – courtesy of The Download Directory! **mm**

Remembering...
Saboteur II: Avenging Angel

Once again, **David Hayward** damages his tendons trying out his ninja skills

Since we looked at the original *Saboteur* the other week for the ZX Spectrum, we thought it was fitting to cover the game's sequel, *Avenging Angel*.

Here we have a game that in itself was amazing but also followed on from one of the biggest and most notable Spectrum hits ever. So it had some rather large shoes, or rather Jika-tabi, to fill.

Following on from the previous ninja arcade adventure, *Saboteur 2* saw the sister of the previous hero, who had met his unfortunate demise, don her ninja suit and take to a spot of revenge, stopping the evil dictator and destroying his command centre deep within a mountain.

This time around, you flew in via a hang-glider and had to time your leap so you landed on the side of the mountain complex instead of plummeting down to certain doom in a crumpled heap at the bottom. Once inside the complex, you had to navigate through the 7000 screens, collect pieces of Punched Tape, kill the guards and escape on a handy motorbike in the lower levels of the mountain.

There were plenty of enemies to do battle with: Androids with flame throwers, pumas roaming the various rooms and levels, and each level increased in difficulty, with the first having you simply escape on the bike, and the following requiring you to steal some papers and escape and so on. When you reached the final stage, you had to do pretty much everything and kill off the resident baddies and their pet pumas.

Although *Saboteur 2* was graphically very similar to its predecessor, it did keep the fans of the original very happy for quite some time. The 700 screens were a mammoth task to map and navigate through and true credit to Clive Townsend's programming skills.

How Townsend managed it with just 48K is mind-boggling, but the 128K version was smoother and included a great tune courtesy of the legendary Rob Hubbard.

Its History

According to legend, Clive traced the heroine of the game from an image in a 'gentleman's magazine'. As it happens, this was one of the first times (if not the very first) that a female was portrayed as the hero of a computer game – as opposed to needing to be rescued.

Did You Know?

- The mission passcodes for each level were ninja and ancient oriental martial arts references. For example, the level 2 code, 'jonin', means 'high ninja'. And level 8, 'dim mak', means 'touch of death'.
- By the time you hit level 8 you'd have no time for fighting. It was just a case of running and collecting the tape.
- There was a secret room under the armoury with a crate that contained invincibility.

Although graphically the same, the animation of the ninja was slightly different, with a wicked flying kick added to her repertoire of moves. There were ladders, umpteen screen-filled drops to oblivion and lifts to navigate through the labyrinthine mountain complex, and all the while the guards and awaiting pumas were at hand to sap your vital energy.

It was a game that took some time to complete, working your way up through the ever increasing levels, but it was worth every second. And to finally escape through the fence on the motor bike was pure Spectrum gold.

The Good

An unbelievably huge game area considering the limited resources of the machine. Ninjas and this time a lady ninja! Levelled gameplay meant you could gradually increase your skills and master every detail of the game.

The Bad

It did run a little choppily on the 48K, but then what do you expect? We have Word documents bigger than 48K, and they're nowhere near as much fun as *Saboteur 2*.

Conclusion

Another excellent game from Clive Townsend and Durrell Software. We're looking forward to the 2015/16 remake, Clive.



The ever impressive Spectrum loading screen – a lost art



Androids lurk in darkened corridors, waiting for any passing ninjas



To escape, mount the bike and break through the electric fence

RETRO ROUND-UP

Retroland buzzes as long-thought-lost Daffy Duck finally gets released, leading Dave Edwards to examine just why finding an unreleased masterpiece seems to garner even more respect than developing and writing your own new one...

In 2012, and if I recollect correctly, Sweden's Loreen won Eurovision singing "Euphoria... From now until the end of time, one day Daffy Duck will be mine, and we'll go oh oh oh..." At least, I think that's what she was singing. Maybe I just heard it that way.

Daffy Duck (In The Great Paper Caper) was, and is, of course, the holy grail of unpublished Commodore 64 games, originally written by Ashley Routledge and David Saunders and due to be published by Hi-Tec Software in the early 90s. But having sent previews of the game out to the leading Commodore magazines, Hi-Tec went under, possibly as little as a few days before *Daffy Duck* was to hit the shelves. *Daffy* quickly became one of the most sought after unreleased games ever and, over the next 18 years, the guys over at **www.gamesthatwerent.com** made almost herculean efforts to find a copy of it. All of them came to nought until 3rd September 2015. On this date came the news that *Daffy Duck* had finally been preserved. This news created a euphoria that I have seldom seen in the retro computing world. So this month, Retro Round Up is paying tribute not to the usual crop of brand new releases, but to games like *Daffy*, brand new 'unreleased' releases. Come with us, and prepare to be amazed...

Daffy Duck (Commodore 64)

I've regularly overheard conversations regarding the search for *Daffy* at retro events. It had its own urban legend in the form of a tale that a box of 250 mastered *Daffy* cassettes had in fact made it out of the door before Hi-Tec's collapse. Finding a single copy of *Daffy* was therefore a thought that was always lurking in the back of all of our minds; every box of 'new old stock' in every dusty warehouse held an extremely remote promise that, just maybe, *Daffy* might be inside it.

There was more too – fake press releases (every April 1st) would raise our hopes that it had been found, only to dash them a few seconds later. Occasionally, an eBay auction – always fake – for *Daffy* would also appear, to exactly the same effect. GTW tracked down the original developers, but they didn't have the game. Ex-employees of the magazines that reviewed it were traced, in case there was the slightest possibility that they had 'liberated' the review copy from the office. No one had. As Hi-Tec had offered *Daffy* at one stage as a competition prize, GTW even traced the winners of Hi-Tec's competitions – 18 years later! – to see if they had received it. Now that is true dedication to a cause. But it led precisely nowhere. Frustratingly, the game that *Zzap64* had awarded a whopping 94% to at the time remained lost. Until now. And the game itself is good. In fact, I doubt C64 owners have been playing a lot else over the past month.

Now I don't want to labour over how the game was finally unearthed here, because it's truly an epic story best expressed by the GTW boys themselves (**www.gamesthatwerent.com/gtw64/daffy-duck**). The great news is that you can download it 100% free from the GTW web site. The not-no-great news is that it did ultimately get 'resurrected' from various old discs rather than by being found complete post-compilation with an inlay card. Importantly, that means there are no instructions for you to read. As the game is a platformer, you might initially think you wouldn't need much in the way of instruction anyway. However, leaping the Warner Brothers' "You're despicable" duck from platform to platform is only one element of the game, with it being something more from the graphic adventure stable than pure platform fun.

You start the game in The Studios with a very cartoony-looking Daffy sprite and a screen that scrolls with you as you move. Each screen features patrolling nasties and rooms to pop in and out of. Curiously, you can speak to certain characters on this level, such as Marc Antony, who will tell you "I'm



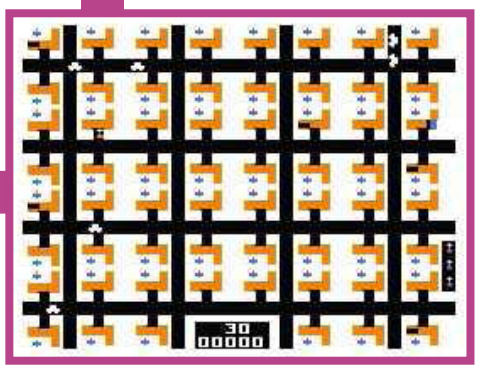
The opening demo has the feel of the Warner Bros. animation



The studios is a small level, and you escape by finding the key to the main gate



In the sewers, it's hard to pick Daffy out against the black background



Poltergeist has three stages. The first is this overhead map, to which you're sent back if you fail later



On the stairs, avoid the patrolling nasties and the circular spirit that homes in on you



Finally, you travel through the 'somewhere' searching for the abducted girl

looking for the lunchbox!!" in response to almost everything you might choose to say. You can also walk left and right, picking up and dropping the objects that you find. If you find you cannot make progress on a certain screen, it is invariably because you haven't found the object you need to do so. When you do have that object, it's automatically used to solve the problem. For example, a plank of wood will nail itself to the ladder that is missing it; you don't need to select it from your inventory manually.

This first level is not particularly difficult, and once I'd stopped running away from all the characters who I'd wrongly figured were fatal to the touch and started talking to them instead, I completed it and progressed to The Sewers. The disc version loads this in about ten seconds and this is a much more challenging and varied series of interconnecting mazes - as well as ladders and platforms!

Daffy Duck is clearly a highly polished product; the graphics are defined to the degree that the game would seem competent on a much more powerful machine than the Commodore 64. The control of *Daffy*, apart from a few quirks with the ladder ascending and descending, is also second to none. Music is loud and bouncy too. Plus it has seven different themed levels, and all are a challenge to solve.

Nevertheless, clearly a lot of time has passed since *Zzap64* was bowled over by *Daffy*. To me, some aspects of it seem a little clumsy. For example, the conversations you can have with the patrolling characters are a bit odd, even if they do their job in 'progressing' the game itself. Plus, *Daffy Duck* suffers from what I think of as the 'licenced platform game cop out' effect. That is, that seemingly every game that features a famous cartoon character, be it Bart Simpson, Garfield or Scooby-Doo, seems to be built with the same Platform Game Designer tools with the main sprite changed to the cartoon character of the title. They all feel samey to me, and in the case of *Daffy Duck*, there's something that reminds me of *Garfield: The Search For Pooky* (Game Boy Advance) about it.

> **"Daffy quickly became one of the most sought after unreleased games ever"**

Poltergeist (Dragon 32)

While *Daffy Duck* represents one of the most epic of struggles, *Poltergeist* for the Dragon 32 is a less dramatic but nonetheless interesting find recently archived by DCC (**www.dragon-it.co.uk**).

As with many 'newly discovered' Dragon 32 games, *Poltergeist* is actually a conversion of a Tandy Color Computer (CoCo for short) game, in turn an official licence for the original Steven Spielberg film. Having been originally released only on NTSC ROM cartridge for the American CoCo market, most of you reading this will never have heard of it. However, with the original movie having recently been rebooted for 2015, most of you will probably be familiar with the plot. Essentially, an army of restless spirits abducts Carol Anne, the youngest child of the Freeling family, by seizing her through her bedroom closet. She is then 'somewhere' in the house itself, able to communicate via the static of the family's untuned television set, until her parents take the decision to cross into the 'somewhere' themselves in the hope of rescuing her.

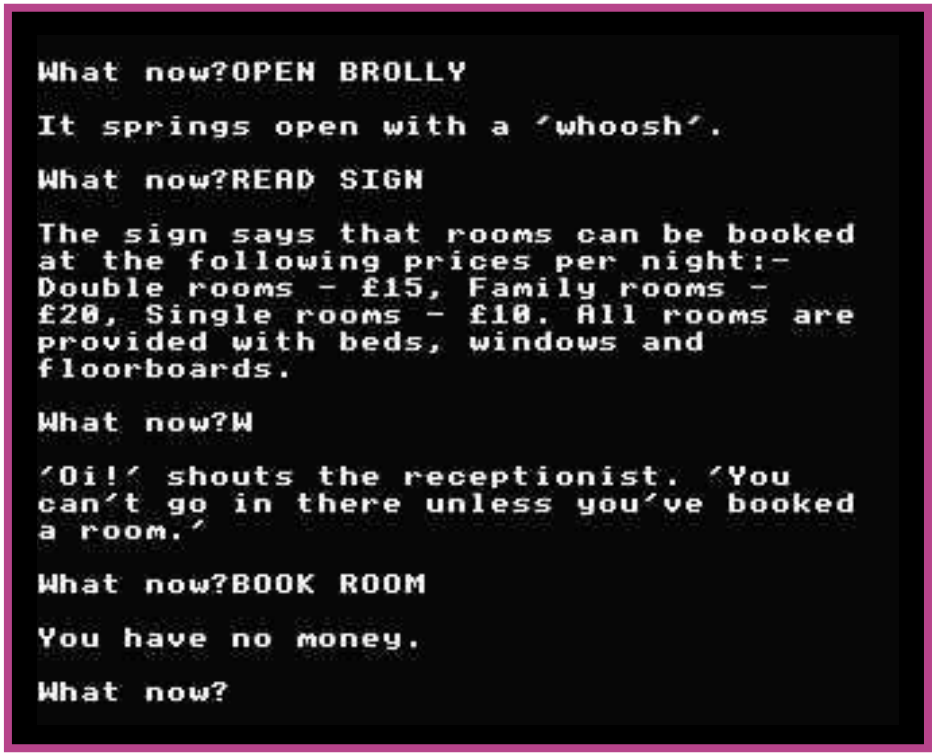
The game is divided into three stages. In the first, you must collect up the equipment needed to enter the 'somewhere' and then locate the Freeling household. In the second, you must climb the stairs, avoiding the spirits that try to stop you. And finally in the third, you must enter the 'somewhere' and blast the poltergeist with a machine gun. This last stage is about as big a departure from the movie as you can imagine, and fighting ghosts with machine guns really seems a very dubious strategy indeed.

Each stage is like a small 5K game in itself, not particularly challenging but varied enough to retain interest. In stage one, you're placed on an overhead map, and you must run around avoiding the cars that drive up and down the totally straight roads to collect up the necessary items. The next stage is viewed from overhead too, and you control a pair of feet, which step up and down the stairs on your command. This requires more skill than you might think – as you must first lure the spirit toward you and then sidestep around it. The final stage is a psychedelic mishmash in which the grinning face of the poltergeist flits about, often agonisingly out of range. If you fail any stage, you're sent all the way back to the very beginning of stage one again.

Originally released for the CoCo in 1982, *Poltergeist* feels extremely dated some 34 years later. I've chosen to review it for purely topical reasons this issue, but many more games that originally didn't make it to the Dragon have now been byte-by-byte converted to that machine, so if you've ever dreamed of seeing Dragon versions of *Pooyan* or *Paperboy*, these have also quite recently also become available from the same place (**www.dragon-it.co.uk**).



In 1987, this may have been considered quite a good loading screen



Dreamtime is an odd adventure, as it's very difficult to keep track of what's expected of you

Dreamtime (BBC/Electron)

Finding, preserving and/or converting old retro games is a struggle. Browse archive sites such as World Of Spectrum or Stairway To Hell, and it's certainly obvious what they've got, but it's not obvious what they're missing. So the usual way of working this out is to browse through old magazines for your machine of choice. Had the progress of *Daffy Duck* not appeared in news stories, it would never have ignited the interest of the GTW web site, for example.

In relation to the BBC Micro and Acorn Electron, however, there was, until very recently, a whole library of games that were mentioned in the press but seemed unlikely to ever be recovered. This library was the Heyley Software range of text adventures. These adventures had been written by Howard Roberts and Tony Heap, available by mail order only in the late 80s, and were distributed by an outfit called ACP/Pres. Incredibly, ACP/Pres advertised their existence by way of a small ad in the pages of Electron User, stating badly "Adventure Games On Disc. £7.95 each", meaning it was at least a few years until anyone even identified their actual titles, let alone set about the arduous task of tracing them.

Dreamtime was the first of these to be recovered, and was found in a box of random Acorn Electron gear several years ago. Having completely escaped review in its day, all that was known about it was that control would be by the usual GO NORTH, GET FLASK commands common to most text adventures. Very pleasingly, however, the version recovered was totally complete with full instructions and hints on play. If you're considering playing it, then you will definitely need to refer to them. *Dreamtime* is a more peculiar adventure than many, beginning when you nod off to sleep and ending only when you manage to solve all the puzzles presented in your dreams.

You're initially placed in a hotel and quickly discover an elevator links all the disparate elements of this adventure together, flinging you not only into different dreams but even into the bodies of different people. The elevator is practically the only constant in *Dreamtime*, in fact, and because you have absolutely no idea what the goal is of any of the characters you briefly become, it's almost impossible to work out what you should do and why. The word that therefore springs immediately to mind to describe *Dreamtime* is 'plotless' and it's one recently unearthed game that should be avoided at all costs unless you really want a text adventure with no real beginning, middle or end.

> **"The word that springs immediately to mind to describe Dreamtime is 'plotless"**

The Treasure Trail

As we've seen in previous columns, retro game 'writing' is something that more and more people are involved in, with new Spectrum releases arriving so quickly that I can now barely keep up. Retro game 'preservation' is an altogether different beast. *Daffy*, *Poltergeist* and *Dreamtime* are three different games discovered in three wholly different ways; *Daffy* was resurrected from development discs, *Poltergeist* was disassembled from a cartridge then re-assembled to a different machine, and *Dreamtime* was discovered in a box. Yet no matter by what means a brand new unreleased retro game explodes into life, it comes coupled with a 'duty' attached.

This duty is to somehow finally give the game to the world. And what can be more fascinating than the game itself are those back stories that lead up to its final release, and the domino effect that releasing it can have. In a small article like this, there isn't so much time to dwell on these, but consider all of the following unexpected outcomes of those who ultimately did take on-board such a duty.

Daffy Duck was known about because of the *Zzap64* spread. *Bugs Bunny: Private Eye* was not known about. In the search to



A little experimentation with the ZX Vega revealed some big flaws

recover *Daffy Duck*, this additional game was recovered too and, as you can imagine, it's up to the same standard. The quest to find *Daffy*, even if *Daffy* itself had never been found, directly resulted in the release of this 'new' Commodore 64 game.

Poltergeist was, for many years, a game known to exist on the Tandy CoCo. As CoCo games, even in the 80s, could be cajoled into working on the Dragon with a bit of peeking and poking, there were often 'unofficial' conversions of them doing the rounds in Dragon User's small ads pages. Hence a Dragon version of the game was 'suspected' to exist. In the event, a request for Poltergeist in the forums of the Dragon Archive led to whole swathes of these 'unofficial conversions' being released.

Dreamtime was, for a long time, the only Heyley adventure recovered. It caught the attention of one Howard Roberts, who helped to write four other Heyley adventures and who reported that all five of them had been lost forever after a thief broke into his car and stole the master disks. In turn, this led to a gentleman who used to work for ACP/Pres remembering that he liberated a few 3.5" disks from its offices and that the Heyley disks were among them. Last year, as a direct result of forum discussions on the back of the initial find, the entire catalogue of Heyley adventures (*Pirate's Peril*, *Stranded*, *The Taroda Scheme* and *The Ultimate Prize*) were made available. These adventures are a lot less random than *Dreamtime*.

It's also amazing how the retro community unites around such finds. If the version of the game that is found is copy protected, someone will step forward to hack past the protection. If there are licensing issues or some doubt as to whether the original author would want the game released, someone will find him and get his approval. And when an 'unreleased' game finally makes it to cyberspace, there are celebrations of the like that simply do not meet genuinely newly written games. Indeed, one person may spend years writing a new game on a retro format and be greeted with indifference, while another recovers *Gemini's Alphabet Chase* and gets the equivalent of a standing ovation. Strange world, indeed.

Soapbox – The ZX Vega

Last month, I took a look at the ZX Vega, which comes pre-installed with 1,000 Spectrum games and said I considered it an essential purchase, despite the fact the majority of its games were new, rather than classic releases. Having now played with it for a lot longer, however, I have some provisos to add to this.

Firstly, it draws its power via a USB port; the idea is that you plug the composite cables into your TV and the USB port too. If your television does not have a USB port, that leaves you having to find the power elsewhere. I can imagine this makes for some quite fiddly setups – a regular three-pin plug socket would have been much more convenient for most people.

Secondly, the picture quality emitted by the Vega is poor. Graphics appear speckled or with 'noise' around them. The user manual indicates that this is more pronounced on some televisions than others, hence whether you're going to be forever squinting at the screen is a £100 gamble.

Thirdly, over 250 of the games it includes are text adventures, which must be played via a baffling 'virtual keyboard' that operates like a mobile phone without predictive text. This is absolute rubbish, and I cannot imagine anyone persevering with such an unfriendly input device.

And finally, the Vega boasts that you can transfer all the games you remember from your youth to it. That's true enough, but it rather inconveniently forgets to mention that they won't work without the keys being 'mapped' to the Vega's D-pad system. So you can transfer them, but you can't play them without some serious jiggery-pokery with the code for the game in question. That's a pretty big omission.

The ZX Vega forums (**retro-computers.co.uk/ZX_Vega_Forum**) were, until very recently, filled with allegations that these drawbacks (and some others) could and should have been remedied prior to release. At time of writing, however, these forums, controlled by the ZX Vega team, have mysteriously disappeared. If this has been done to stifle such criticism, then that's rather unsettling too.

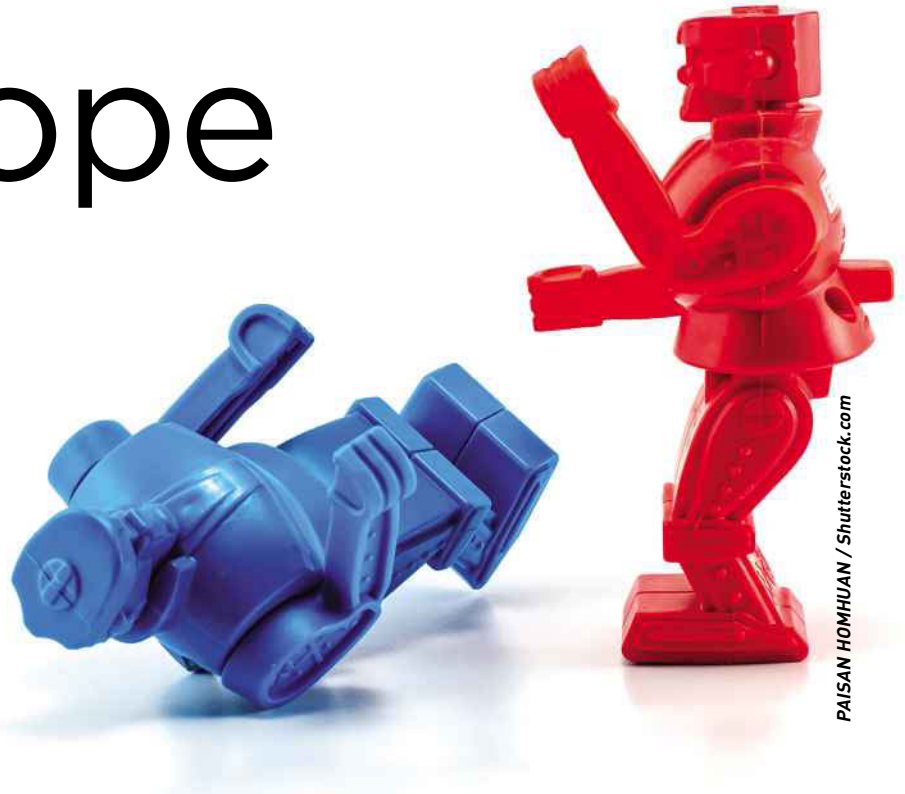
Now I personally can live with almost all the Vega's flaws – the sheer volume of great games on it (even if they come without instructions) is incredible. But the killer is that poor quality video. As soon as customers realise that they'll get a far clearer, sharper picture using an emulator on their PC, I suspect a lot of them will simply want their £100 back. **mm**

Games That Weren't (www.gamesthatwerent.com)		
Daffy Duck	Commodore 64	Free
Dragon 32 Universe (www.dragon32universe.info)		
Poltergeist	Dragon 32	Free
Stairway To Hell (www.stairwaytohell.com)		
Dreamtime	BBC/Electron	Free
Pirate's Peril	BBC/Electron	Free
Stranded	BBC/Electron	Free
The Taroda Scheme	BBC/Electron	Free
The Ultimate Prize	BBC/Electron	Free

App Battle

Meerkat Versus Periscope

It's a face-off between two streaming apps as Rob Leane puts Meerkat and Periscope to the test...



PAISAN HOMHUAN / Shutterstock.com

Exciting new apps often come in pairs, with two catchy names offering very similar services and simultaneously finding big success. Today, we're investigating one such instance of this phenomenon: live streaming apps Meerkat and Periscope.

Both of these free apps allow you to live stream a video feed for your friends or followers to watch live. On the flip side, you can also use either of them to watch live videos from your friends, family or favourite celebrities.

Technically, Meerkat came into the game first, reaching the app stores on both iOS and Android in February of this year (that's 2015, fact fans!). Periscope followed around a month later, available for download during March of the same year. Periscope is owned by Twitter after a $100 million buyout, while Meerkat is a smaller independent effort headed by Ben Rubin and the company he founded, Life On Air, Inc.

Both apps have been downloaded millions of times. But what's the difference between them? Is one better than the other? Is one of them definitely worth avoiding? Micro Mart gave them both a test drive, focusing on the two basic functions of watching and streaming, to answer all these questions and more…

Watching

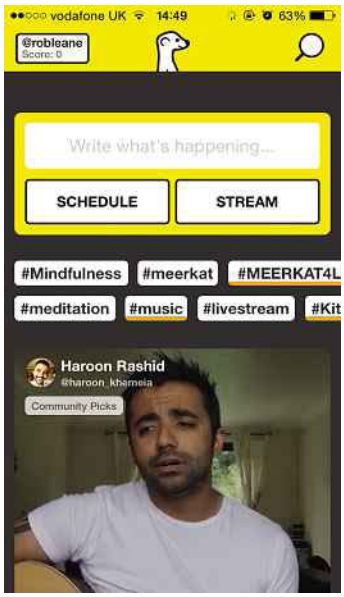
On first impression, Periscope is very intuitive and easy to use. You're given a few basic tips (i.e. you can react to videos with 'hearts' and comments) before being asked to log in with your Twitter credentials or your mobile phone number. You're then taken to a Google Maps style view of Earth, where red circles will indicate where in the world you can watch live video from at the moment.

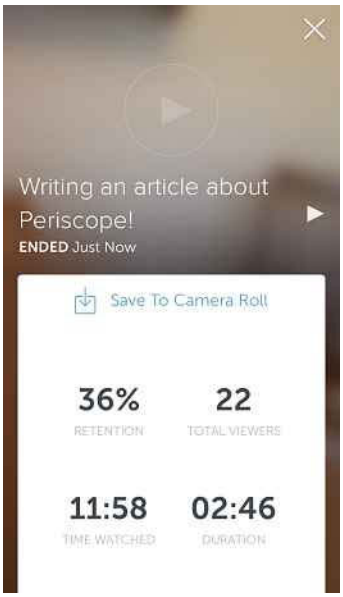
Immediately it's clear that there's plenty to watch: around the UK people are currently streaming their lunches, bad weather experiences and meetings (for some reason). Everything I click on has a few people watching, and there are always a handful of comments popping up too.

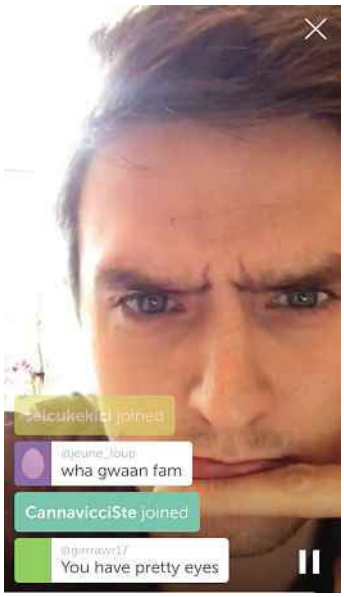
It's a fun way to interact; it's easy to 'heart' something and show your appreciation for a funny or interesting video. You can see how it's possible to become addicted to this sort of thing. It's Twitter on an even more intimate level. The fascinatingly mundane nature of life is being streamed worldwide to satisfy your intrigue. You could happily click around for hours and find a whole range of random stuff that might pique your interest.

Over on Meerkat, it's a little bit more complex to sign up, but it's still massively simple. You have to enter your phone number and punch in the four-digit code it sends you. It promises that your number will never be shared, then recommends a few celebrities (Snoop Dogg is a prominent Meerkat apparently) and ask you to connect to Facebook and Twitter to get yourself some friends.

It's worth noting at this stage that once you link Meerkat up to your Twitter account, every comment and like you make on a video









will be sent to Twitter as well, which could become a bit irritating if you interact a lot. You can switch that off or disconnect whenever you want, though.

In terms of the central hub page, Meerkat offers a Facebook-esque timeline page instead of a map of potential streams. Here, a selection of curated 'top videos' are presented for your consideration. A chap called Haroon Rashid is busking on his acoustic guitar; someone else is showing off some swirly visual art.

There's less clicking around to find content, but this does backfire a little. It's less like being included in an interactive experience and more like you're being presented with a selection of random stuff you didn't necessarily ask for. Once you've used it for a while, though, you should start seeing people you know there instead.

I'm told up in the top-left corner that my 'score' is zero, but there isn't any information to explain what that means or how to improve it. Once you click on a video, it'll load up within a few seconds. On your first video, Meerkat is kind enough to post a comment for you: "This is my first time watching video on Meerkat!" This seems a little intrusive, in all honesty.

Winner: Periscope, by far, makes a more user-friendly first impression. Surfing for videos is easy, and there always seems to be some form of discussion going on,

Streaming

At their cores, I can report that Periscope and Meerkat do indeed have the exact same idea: streaming video, for free, on your phone. It wouldn't be a fair product comparison if we didn't review the streaming part as well as the watching things bit, so we decided to give this daunting task a go.

First up, we clicked Periscope's camera button, which is one of four icons along the bottom of the app's main page. You need to give it access to your camera, audio and location to proceed any further, but you're allowed to hide your location whenever you like. Admittedly, I was a bit frightened at this stage, having zero aspirations to be a star of the big, small or very small screen.

However, once I'd picked a title for my stream ('Writing an article about Periscope!' – catchy, I know) and taken the plunge of going live, it was a fun experience. Somehow the stream had 22 followers within three minutes, presumably out of people's intrigue and some random clicking around on the map page.

A Twitter friend got a notification on their phone about it and decided to stop by. People 'hearted' it. Someone said I had nice eyes (which, admittedly, freaked me out a little). All I was doing was sitting there showing my humble working process of coffee, biscuits and a laptop. It was fun, and the process had a sense of buzz and community to it. A few more views came in afterwards too, and Periscope gives you full stats about who watches and what bits they hearted. If I had anything exciting to show off, I'd definitely stream using Periscope again.

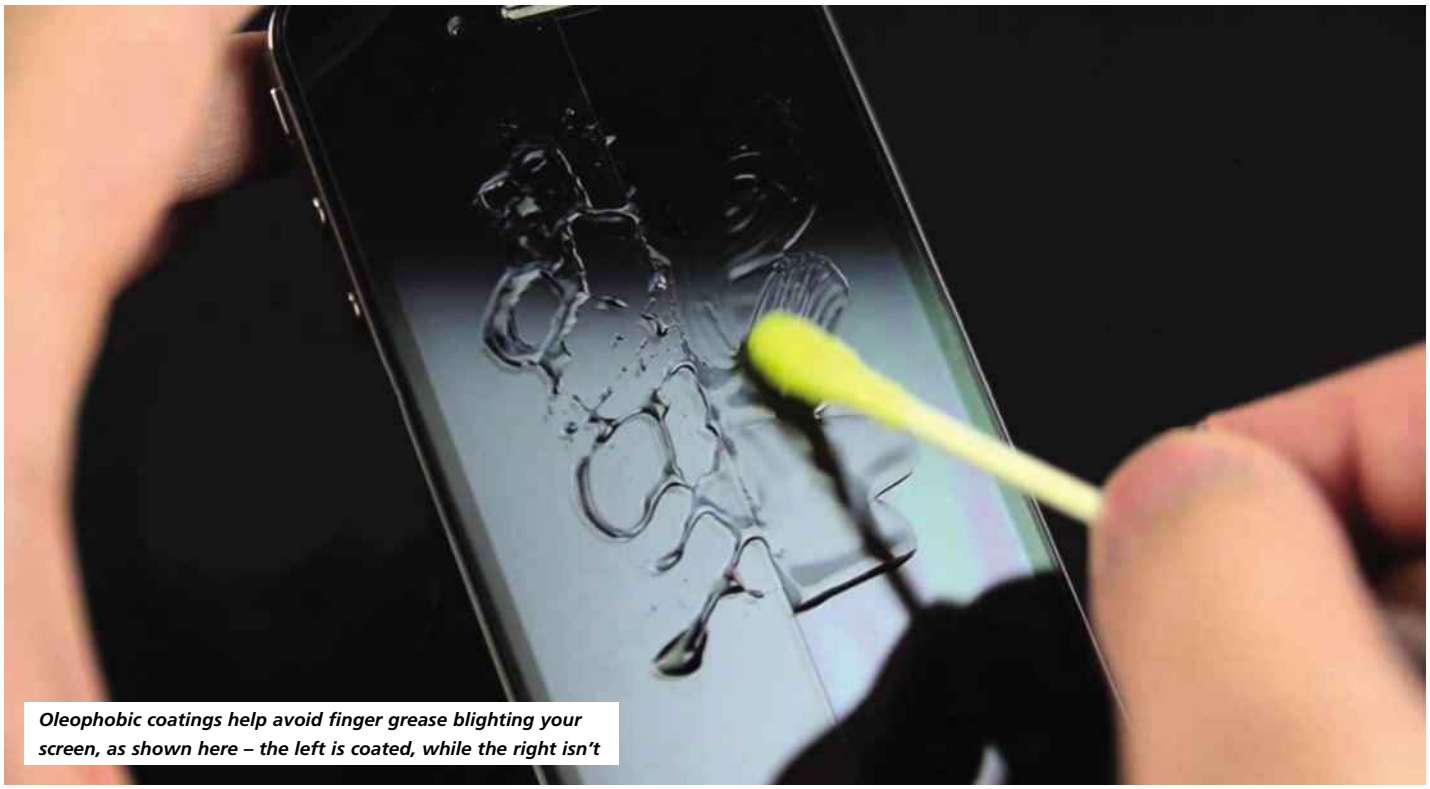
Next, then – Meerkat. The streaming functionality is pretty much the same, asking for a few permissions before streaming your phone to the world. You can press a button to switch from the camera on the back to the selfie mode. You can turn the flash on or off. You can post a message to people watching. Also, as soon you start streaming, Meerkat will post to Twitter about it, from your account. That came as a bit of a surprise, but not a major shock in this interconnected age.

Perhaps a little buoyed by the response on Periscope, I was expecting Meerkat users to take a lot of interest in my desk and ply me with compliments about my facial features. They, um, didn't. After a few minutes of streaming, only one person was watching, and they didn't say anything. Not even about my eyes.

Perhaps if I'd stuck with it for longer it would have picked up a bit, but I'd seen enough to spot the contrast. For first timers, Periscope is quicker to take off and stimulate a community feel, while you may need to work a bit harder to gather any interest on Meerkat.

Winner: Periscope again. For a first go on a new sort of social interaction platform, I felt very included and welcome. On Meerkat, there was less of an immediate response.

Overall winner: First impressions tell me that you'll have more fun on Persiscope. There's plenty to watch on Meerkat, but it's just not as easy to understand or quick to take off. **mm**



Oleophobic coatings help avoid finger grease blighting your screen, as shown here – the left is coated, while the right isn't

Are Expensive Screen Protectors Worth It?

Keir Thomas splashes the cash to see if screen protectors costing more than a few quid are worth it – plus, what's the best way to keep your screen clean?

Screen protectors are cheap. In fact, they're often entirely free, given away with other products such as phone cases. For larger items like tablets and laptops you'll have to hand over cash, but that's when you discover there are hundreds of different makes and price points. Some prices can be eye watering.

If you've ever wondered if paying up to £20-£30 for a humble screen protector is justified then we're here to provide the answer. We ordered in several of the priciest high-end examples from Tech Armor (**techarmor.com**), Martin Fields (**martinfields.co.uk**), QDOS (**qdossound.com**), Expert Shield (**expertshielduk.com**) and NuShield (**nushield.com**), and then put them through a handful of usage tests. The results are surprising. Read on to learn more.

What's On Offer?

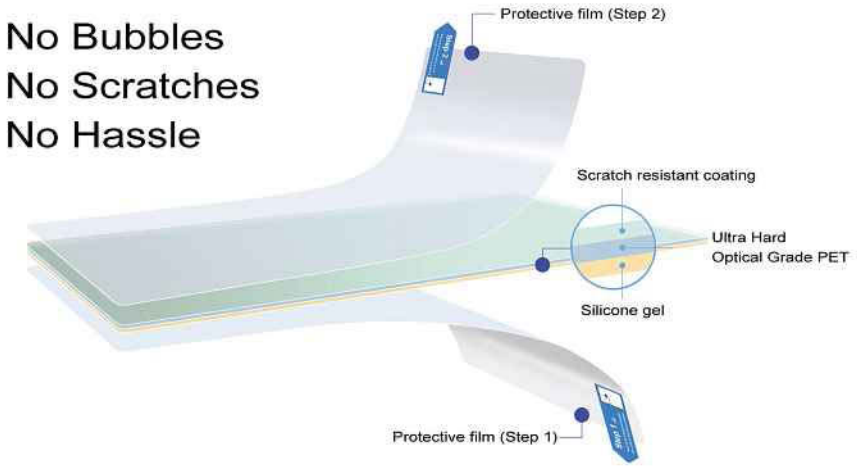
Part of the higher asking price for these screen protectors goes into marketing and packaging, with most keen to sell their advantages over the plastic film that can be had on eBay for next to nothing. The most common claim is scratch and damage protection, and the price premium sees this taken to extreme levels. Tech Armor's 'HD Ballistic Glass' protector range, for example, will set you back £10 on account that it "will absorb almost any impact".

We were unable to test the product name's implied protection from ammunition, as the *Micro Mart* service revolver was holstered firmly to the editor's hip on the day we wrote this feature. However, it clearly suggests that dropping even a heavy weight with a pointy edge directly onto your phone or tablet's screen should equate to no damage – or damage resulting only in a cracked screen protector. Indeed, some of these screen protectors are advertised with a picture of an electric drill attacking the screen.

To make this kind of protection possible, the screen protectors we looked at were made of thick treated plastic or – more commonly – actual glass that's tempered to



Tech Armor offers its Edge to Edge product that protects the entire façade of a phone, including non-screen areas



High-end screen protectors either use tempered glass or treated and toughened optical grade PET plastic

give it extraordinary hardness. In other words, it's like applying a screen to your screen. Weirdly, the glass is so thin that it flexes under compression and, yes, it will shatter if you bend it too much (we tried). Most of the protectors use a light glue to ensure adhesion to the screen although some rely on static cling – something that we found to be surprisingly effective.

In addition to scratch and damage resistance, screen protectors might have extra features such as antimicrobial action. Some claim to help minimise reflections, which can be a huge issue when using your phone outside, or near a bright window, or in the car when using satnav functionality. An example of this is the NuShield Triple A Antiglare Protector, which we looked at and that retails at around £8.

Some screen protectors attempt to offer privacy by radically restricting the viewing angles of the LCD display of your phone, tablet or laptop so that you can only see stuff if you're looking straight at the screen. This is ironic when you consider that many of us pay a premium for the likes of IPS displays, designed to make for the maximum possible viewing angle, but when using devices on public transport it can be a Godsend.

A third type of additional feature is a mirrored surface, allowing the phone to be used to adjust hair or makeup. Again, this is somewhat ironic considering most display coatings attempt to minimise reflections. However, such screen protectors only act as a mirror when the screen is switched off and entirely dark. Essentially, they work on the same principle as the mirror film often applied to car or office windows, which are reflective only if the non-mirrored side of the coating is darker than the exterior.

A fourth intriguing additional optional feature is anti-blue light filtering, as offered by the QDOS OptiGuard Glass Blue (£20). This filters out some of the blue light from a screen, supposedly reducing eye strain and helping to prevent sleep patterns being disrupted by screens – a very modern problem. Again, though, we question any desire to compromise the typically good colour reproduction of a mobile device.

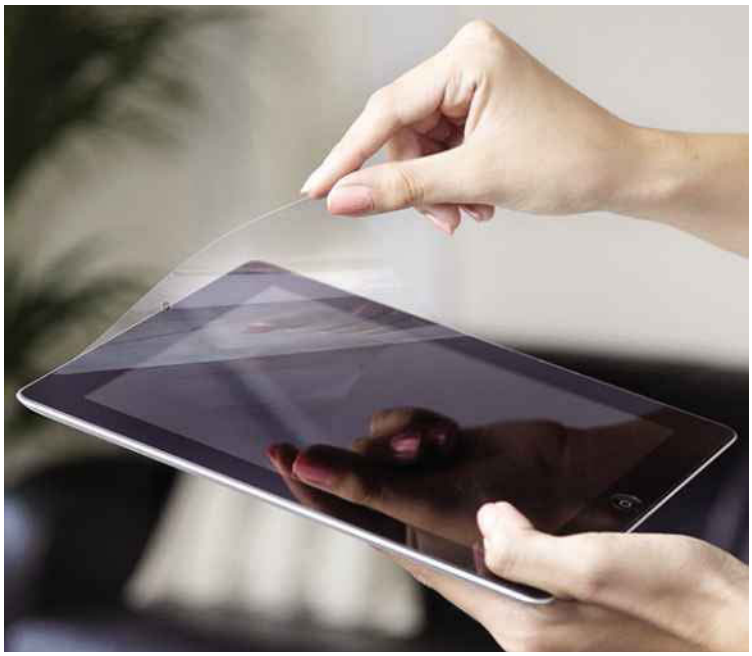
Do They Work?

Unsurprisingly, the clear screen protectors were essentially invisible once applied. We looked long and hard to see if they affected colour reproduction or sharpness on our test iPhone 6 Plus, even employing a jeweler's magnifying loupe to view individual pixels, but couldn't spot any difference. This also meant that the screen protectors were just as shiny and reflective as the screen itself, however, which wasn't as welcome. Another benefit of their higher asking price was that all the examples of protectors we looked at were oleophobically coated, which means they're resistive to finger grease and oils. This didn't seem to work any better than the standard oleophobic coating of the screen, but as such was a welcome addition.

Incidentally, touch sensitivity didn't appear to be affected in the slightest even with the thickest screen protectors we looked at. Indeed, because these protectors are thick we were able to easily apply them without

Should you attack your phone with a hammer – perhaps during a particularly frustrating round of Happy Wheels – then the screen protector will take the damage, rather than your device





The thicker a screen protector then the easier it will be to apply – a glass protector makes it almost impossible to end up with air bubbles, for example



It isn't just phones, tablets and laptops that can benefit from screen protectors. You can get them for most cameras, too

air bubbles appearing beneath the surface of the protector – something that can't be said for the cheap thin screen protectors that cost pennies. This also helped our blood pressure level because at most we had simply to peel back the protector a little while applying if it looked like an air pocket was forming.

Alas, it wasn't such happy news with the screen protectors that offered additional features like privacy protection or protection against reflections. These are microscopically etched or coated to achieve their goals, and this affects what you see. Both the privacy and anti-reflective protectors we tested introduced a shimmering look to the screen when looking at it straight on, a little like the contents of the screen are in the very early stage of being beamed up à la *Star Trek*. We also noticed an interference overlay, like a very slightly badly tuned telly from the days of the analogue signal.

As damning as all this might sound, these issues were not annoying or even all that noticeable in every day use. However, we wouldn't like to be editing or viewing photos with such a protector applied. These protectors are also darker than plain glass, and this can mean you have to boost the screen backlighting – something that will, of course, drain the battery more quickly. Colour accuracy will also be hindered, although we noticed only a very slight dulling of vibrancy.

The NuShield Triple A Antiglare Protector didn't exactly stop bright windows reflecting on our phone screen but instead diffused strong reflections so that they weren't so noticeable or clearly defined. This was extremely welcome, although if you simply can't bear any kind of light bouncing off the screen, perhaps for medical reasons, then it might not be enough. It certainly helped when using the phone outdoors in the few hours of bright sunshine this Summer offered, however.

The Tech Armor 2-Way Privacy Screen Protector (around £20) blocks viewing from angles other than straight on. However, this relies on the ambient light in the room also being fairly strong – something that's not always the case on public transport, for example, where these things are likely to find most use. However, in ideal situations the screen appears black to any viewing angle other than around 30° outside of an eye position straight on to the screen. Weirdly, this protection only applied to viewing from the side. If you view from above then there's simply no protection at all.

If the ambient light is more gentle, even the results from the side aren't so good and passers-by might be able to make out what's happening on the display, albeit through a hazy fog and with inconsistent visibility across the screen area. However, it remains impossible to discern details. The person next to you on the train who's nosily peering at your screen might realise you're working on an email, for example, but they won't be able to make out any of the words – and arguably this is all that's required. Still, if you want to watch a movie without anybody nearby being distracted by the on-screen movement then this might not be what you're looking for.

In short, we felt a little like the screen protectors offering additional features outside of scratch and damage protection were certainly better than nothing, but they weren't the comprehensive solutions we would've liked and forced compromises on the user too.

Other Things We Noticed

With our selection of posh protectors we noticed a handful of additional things. Firstly, a decent screen protector vanishes existing scratches on your screen while it's applied. It's like returning your screen to new. Our test iPhone had a few grazes caused by putting the phone in the same pocket as keys, for example, and even a small hairline crack at the top. With the screen protectors these marks disappeared like magic.

Secondly, what might be described as the finger feel of a screen protector is different compared to the naked screen. This doesn't mean a great deal in everyday use, but if you're a keen phone or tablet gamer it can help add a bit of accuracy. In fact, the various protectors had differing feels. Most of the clear glass and plastic coverings offered more swiping resistance than the standard screen, although this might've changed as each became worn in. The NuShield Triple A Antiglare Filter had a slightly grainy feel that was actually quite nice and a real tonic compared to the slipperiness of plain glass.

Lastly, we couldn't help noticing that some of these screen protectors added weight to the device they were applied to. It seems silly to complain about this – a glass screen protector we selected at random for weighing on our kitchen scales came in at just 11g (0.4 ounces), for example – but phones in

particular can be dramatically lightweight nowadays. The Samsung Galaxy S5 Mini is only 120 grams (4.23 ounces), as one example, so such a screen protector would add almost 10% more weight.

How To Fit A Screen Protector

The expensive screen protectors we looked at came with some very detailed instructions on how to fit them, and we're happy to provide a summary of their wisdom here. Many even came with cleaning and preparation kits. Start by washing your hands thoroughly with soap and water. This will remove most finger grease and therefore lessen the possibility of fingerprints accidentally appearing.

A surprising amount of clear work surface is required to effectively apply a screen protector too, because you'll need to clean and unpeel things and put them down safely without the risk of them getting dirty.

Give the screen a good clean before starting too. The manufacturers of our screen protectors advise using the likes of 3M Scotch-Brite products, while some came with their own cloths and alcohol wipes, but we recommend clean microfibre cloths of pretty much any variety. Give the screen a firm rub to remove all grease and dirt. We particularly liked the sticky pad that came with the QDOS OptiGuard whose sole purpose is to be used to remove dust by dabbing it on the screen. You could do the same with Scotch or electrical tape, of course, although here's a pro tip for any price level: A blob of Blu-Tack fresh from the packet is an excellent screen cleaner, removing dust particles and soaking up grease and oils. Just rub it across the surface (don't roll, which won't work as well). Blu-Tack can also be depressed lightly into the likes of speaker grilles to remove debris, although you aren't advised to insert it into deeper crevices like the earphone jack.

Peel the adhesive backing of the screen protector using its tab and then line up the protector with the screen surface. The speaker grille at the top of most phones usually provides an excellent orientation point. Wrap a tissue or microfibre cloth around your finger, and then use it to smooth and flatten the screen protector as you apply it to the surface while simultaneously pulling back the adhesive protection. Note that we fitted upwards of five screen protectors to our phone during the writing of this feature and not once did we manage to get perfect accuracy. The screen protector was always a millimeter or so out of alignment with the speaker grille and home button. Unfortunately, it seems the best plan is simply to accept this as an inevitability.

Some iPad protectors come with suction cups that can help position the protector before applying. Should you be left with air bubbles post-application then use the cloth or tissue to push them out to the edges. Resist the temptation to remove the protector and reapply it because most are designed to be applied only once. Some screen protectors might show glue blemishes that look like air bubbles. These should disappear within 24 hours.

To remove a protector at the end of its life, stick a piece of sellotape to the corner so it overlaps the edge, and then lift.



Some screen protectors offer privacy protection, which works by radically reducing the viewing angles of the screen

Cleaning And Liquids

While glass screen protectors offer clear advantages over cheap plastic film counterparts, and are therefore worth the investment, we find it harder to recommend specialised screen cleaning products. For example, the microfibre cloths we picked up at our local pound shop work just as well – if not better – than any of the cloths supplied with the products reviewed above.

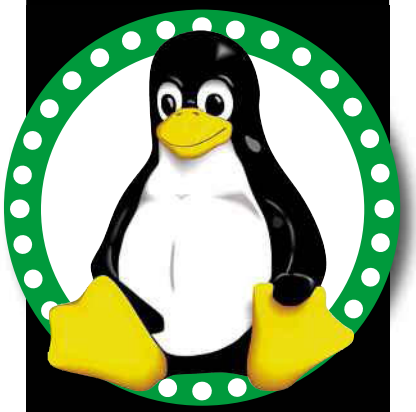
Some liquids such as the Monster iClean Screen Cleaner (around £22) claim to reduce static electricity on the screen, avoiding dust being attracted to it, but anything wet in contact with an electrical device is surely questionable. Simple rubbing with a cloth is best. Alcohol-based screen cleaning wipes – usually identifiable by their distinctive sharp smell – should be used sparingly because they may wear away the various screen coatings. You definitely shouldn't polish a touchscreen device using any commercial polish because you could even wear away the touch sensitive coating!

That brings us to perhaps the only valid use of protective liquid on a touchscreen device, which is to either apply an oleophobic coating if the device doesn't have one (as with some cheaper tablets or phones), or to reapply a coating to a device that's become worn through use. Products such as Crystalusion Liquid Glass (around £6) are a good example, although no-brand oleophobic liquid products can also be found on eBay. In most cases a few drops are applied to the touchscreen surface, and then wiped over the entire surface with a cloth. Drying occurs almost instantly.

Our verdict

If you have some spare cash after buying a phone or tablet our main recommendation is to get a decent quality case. The number one cause of death of phones and tablets is a cracked screen caused by dropping on the floor, and a case will help minimise the possibility of damage.

However, the screen protectors we reviewed were a revelation, and if you've written off protectors because of bad experiences with cheap examples then they're worth a look. Above all, if you apply a screen protector early in your phone's life then you'll protect the surface from scratches. Add in a decent case, and in one or two years' time when you come to upgrade to a newer model your old model will look like new – and should fetch excellent resale value. Second-hand Apple products in particular can sell for incredible amounts of money, and near mint examples are rare. **mm**



Kernel 4.3 RC2 And Steam Drivers

Things are moving on

Linus Torvalds spoke up a few days ago with regards to the inevitable launch of Kernel 4.3 RC2, which promises to be a fairly normal set of updates and architecture fixes. As he explained on his blog. "We're on the usual Sunday schedule and -rc2 is out there. As has been the trend for a while now, rc2 tends to be reasonably small, probably because it takes a while for regression reports to start trickling in (and some people probably actively wait for rc2 to even start testing – you scaredy-cats, you). So if somebody didn't dare update right after the merge window closed, jump right in. We need people to test and report."

That amounts to some fairly light-hearted ribbing, but nothing too drastic. Though it does mean you're more than unlikely to have it break your current test setup, if you have one. As the man said though, the Kernel team needs people to get on board and start testing and more importantly, start looking out for and reporting any bugs you find.

Steamy Kernel

In addition to the new fixes and so on with the launch of RC2, Valve have also announced something that may come of some interest to the Linux gamer among you.

With the worldwide sale of the Steam Controller ready for November 10th, the Kernel release team have been looking into a better Steam Controller driver for Linux, to be released for Kernel 4.3 specifically.

This, of course, means that the touchpad elements and all the other cool stuff that Valve has promised us for the Steam Controller should be up and running ready for the next Kernel update and ready for the latest release of SteamOS for the Steam Machines.

If that's not good enough for you, then it has been recently reported that Steam now has passed the 1,500 available games milestone for the Linux platform. So at least you'll have enough content to use the controller with when you finally get your hands on one later in the autumn.

To be honest, we're quite jealous of the Kernel team, getting hold of the Steam Controller before we could. Still that's what you get for being a top coder I guess. Good on them, I say.

Actually, while we're on the subject, we were talking the other day at how much of an impact the Steam Machine, Controller and an improved version of SteamOS will have on the gaming market. Will it boost sales for the PCs – as it were – or will it simply be forgotten, much like the Ouya and end up being sold on eBay for a fraction of its original cost?

We're not expecting it to suddenly unite Linux with the rest of the world overnight; nor to sweep the OS into the top system spots in the charts. It certainly can't do the platform any harm, though, surely..? Or could it?

What do you think? Are you impressed by the specs of the Steam Controller? Will SteamOS, Steam machines and the controller boost the desktop Linux numbers – even if the end user may not realise that SteamOS is in fact Linux based. Or will it fail before even getting its feet off the ground?

Write in and let us know what your predictions are.



An improved Steam Controller driver for Kernel 4.3

David Hayward has been using Linux since Red Hat 2.0 in schools, businesses and at home, which either makes him very knowledgeable or a glutton for extreme punishment

Playing The Game

The new Apple TV could be great for gaming, but it instead highlights how Apple still doesn't really understand games at all

Apple recently unveiled a new Apple TV alongside the iPad Pro and new iPhones, and games played a major role it is specifications. On stage, Apple showed off a cramp-inducing controller – first tackling a multiplayer *Crossy Road*, and then being waved about like a Wiimote to bat away balls in a Wii Sports-style rhythm game. More complex fare was also talked about, though: *Guitar Hero* with its plastic instrument, and a range of 'cinematic' titles. Apple isn't about to go toe-to-toe with the Xbox, but its direction would at least enable it to match the 'TV box' competition that had blazed ahead.

Only then, we began being drip-fed information about the limitations of the system. No persistent local storage means games will have to support iCloud – something the majority of iOS devs appear allergic to. Game binaries are restricted to 200MB in size, with up to 2GB of extra data being locally cached, but possible for the system to purge. This will increase complexity of development, but also potentially cause issues for gamers switching between a number of large titles if they lack enough free local storage to house them all.

The biggest problem, though, has been Apple performing a handbrake-style U-turn on external controllers. When the initial documentation was released, it stated games could require the use of a more typical console-style controller. This seemed eminently sensible. Although the Siri Remote can feasibly work well for some simple fare – as per the *Crossy Road* demo – a video of it being used for racer *Asphalt 8* looked comical and painful. And when you consider the kinds of games Apple was talking about at the event, it was clear this remote would – at best – be sub-optimal. Nevertheless, Apple has stated that all games must support it.

If you've not seen the Siri Remote, it's somewhat similar to the Wiimote. But, whereas Nintendo's decade-old controller was cleverly optimised for both menu navigation and gaming, the latter is clearly an afterthought for Apple. Flipped on its side, the touch surface doubles as directional controller and 'button A' through a long press – hardly ideal for most games. Play/Pause becomes 'button X', despite it being housed towards the middle of the controller. And that's it.

I've had plenty of people argue this is just fine and that by enforcing the Siri Remote's use, Apple will ensure a better user experience through no-one downloading a game they can't play. I can't help but feel there are better solutions, not least the obvious one of warning someone before they download a game that requires a console-style controller. And what happens to those games announced at Apple's event? How can you be a *Guitar Hero* without the guitar? What message does it send to developers when they learn Apple's again chopping and changing its requirements and that it still doesn't have a clue about gaming?

It's funny to think that the original Apple II's specs were largely dictated by games; Woz wanted to ensure it could run a decent version of *Breakout* that he could show off to his computer club chums. Ever since that day, though, you feel Apple's been at best ambivalent, or outright hostile, to gaming. Games succeeded on iPhone despite Apple rather than because of it. On the Mac, gaming dodders along, in part through the Mac's increasing sales and the tendency of Apple fans to pay money for things. Even there, though, gaming's still quite weak, the majority of titles on the Mac App Store being iOS ports. With Apple TV, Apple had the chance to think different; instead, we're heading for a compromise that won't really benefit anyone.



▼ ***Apple TV games look nice, but will force people to use the Siri Remote***

Craig Grannell is a writer, designer, occasional musician and permanent loudmouth. He's owned Macs since 1996, when Apple was facing certain doom, and is therefore pleasantly surprised by its current success. Find **Craig** on Twitter at **@craiggrannell**



Time For Nine

Ian McGurren risks an iOS update

Ian is a professional IT analyst, a semi-professional writer and a pretty amateur electronic musician. He likes gadgetry and loves making gadgets do things they were never designed to do

If it's September, it must be new iPhone / iPad time, and for those of us not getting shiny new kit, it means new iOS time. We're on our ninth revision now, is there any big news? To look at, iOS 9 isn't a huge departure at all from the flat look debuted with iOS 7. The most obvious change is the system-wide font change from Helvetica to the Apple Watch's own San Francisco. Personally, it's not a switch I'm fond of; San Francisco is not a strong font, and the spacing makes it feel somewhat immature.

Also added to the UI is a so-called 3D Touch feature that makes use of the new iPhone's force touch screen to add a sort of click-and-hold functionality with contextual menus – hold on the photo icon and you get to choose tasks before the app loads. Most of what has been show could maybe be duplicated with just pressing longer, but that wouldn't make Force Touch "amazing", would it?

Other major changes come in the shape of dual screen multitasking and floating video, both of which should be familiar to Samsung owners. It's still welcome here, and handled well with a swipe in from the right of an app revealing a list of apps to run either in a quarter screen or even half screen. Not all apps work in it yet, it has to be added in by the developers, but many of the usual suspects – Twitter, for example – work, and allow interaction such as copy and paste between the two apps. Floating video, also quite familiar to Android, is pretty much as it says on the tin, and is slightly less widely used. So far it's limited to Apple's Video app, and, far more usefully, YouTube and FaceTime. Note that both of these features are iPad only, with not even the 6S Plus getting in on the split-screen action.

The made-over Siri has been expanded somewhat, becoming a bit more Google-like in its omnipresence. There's more contextual help including the useful "remind me of this" feature, when using a compatible app, such as Safari, to be reminded of the information on the page later. There's also intelligent assistance, such as the ability to play or show items to a specific request, though my request for it to compile a playlist for 80s Rush albums on Apple Music was met with a stony silence, possibly for the best. For all the improvements, though, Siri is still rubbish at answering questions, with most simple queries leading to a "here's what I found on the web" – I can do that, I want you to tell me instead.

The bigger iOS9 changes are less visible. A low power mode has been added to eek out the last few percent of the battery life, and Apple's Metal graphics code has also been applied to the UI, giving devs low-level access to the GPU to make those user interface elements whiz and fly. Also in iOS 9, universal apps now can safely dispose of those elements not needed for the platform, so iPad apps can jettison the iPhone code and save space, which with games and textures, could potentially be quite a bit. Even installation is easier, being cumulative (i.e. just downloading the new iOS9 bits and not the whole GBs that iOS 8 wanted). Finally, ad blockers can now be installed, instantly provoking a debate about how we 'pay' for the free internets...

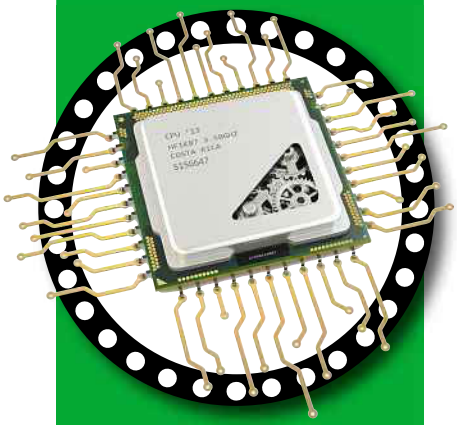
> **"We're not going to get a surprise with iOS, Android or maybe even Windows Phone"**

We're not going to get a surprise with iOS, Android or maybe even Windows Phone for some time so, for now, each OS is a refinement of the last. iOS 9 remains a very capable mobile OS, and it continues to grow, even if we still can't use USB or access the file system. For now though, it's pretty good going. But can you close all your apps at once yet? Can you heck...



Mobile

Fitter, Happier, Possibly More Productive



Can a fitness-focused smartwatch and iOS 9 make Andrew Unsworth fitter, happier and more likely to put the kettle on?

As I've recently rediscovered the joy of going to the gym I've also started to think about smart devices to help with fighting the flab, even though I'm sceptical of them. The trouble is that too many of these devices seem to forget who is the master and who is the servant. I want to enjoy my workouts and push myself, so all I want is a device that'll tell me what I did and let me compare results over time. The last thing I want is a demonic cross between *Red Dwarf*'s Queeq 5000 and the last prize to be picked in a raffle barking in my ear when I take a pleasant stroll to the corner shop.

That's why my interest was piqued by the TomTom Spark (**tinyurl.com/qdjynnx**). It's a smartwatch that also comes with a built-in music player, which means you can leave your phone safe at home when you go to the gym or for a run. Also, the TomTom Spark has a built-in heart monitor, an activity tracking feature, and the ability to chart distance and calories burned.

The built-in music player can stream to Bluetooth headphones so you won't have to worry about wires getting in your way, and what's more, the Spark comes preloaded with a 30 minute mix from Ministry of Sound. It looks like the kind of thing I've been after.

IOS 9

By the time you read this iOS 9 (**www.apple.com/uk/ios**) will have been out long enough for you to have played around with it, but that isn't going to stop me waxing lyrical about the new battery-saving feature. I'm slightly ashamed to be so happy about it because certain other smartphones have had battery-saving features for a while now, so it isn't something new and cutting-edge, but I don't care. With the feature engaged the iPhone turns off graphical flourishes, the fetching of mail and the running of background apps, among other things. Apple says that doing this should give you a bit more time with a working iPhone.

I put this claim to the test today when I forgot to bring my phone charger into work. I ended up putting my phone into Low Power mode around 15:30 with the battery at less than 5%. I also switched off wi-fi and mobile data such was my panic. Sure, the smartphone became dumb for a few hours, but as I just wanted a phone I could use in an emergency should the worst happen on the motorway home, that was fine with me. Sure, I had the phone in sleep mode for all but the tiniest time, but even so, when I got home gone 19:00 I took the iPhone 6 out of Low Power mode and it still had enough juice to give me a minute's worth of Facebook before finally giving up the ghost. Yes, I know this is flimsy anecdotal evidence, but I think this new feature is great, and anything that helps keep a smartphone working longer is a good thing.

Other new features include improved search, improved personal assistance from Siri and, most usefully, the ability to slide a new app on screen without closing the old one – and there's also the ability to view two apps side by side. IOS 9 also feels snappier and more responsive, which is most welcome. If you have a compatible iOS device you should definitely get iOS 9 downloaded and your device get upgraded ASAP.



Andrew Unsworth has been writing about technology for several years, he's handy with a spanner, and his handshaking skills are second to none



Ryan Lambie has loved videogames since he first stared up in awe at a *Galaxian* arcade cabinet in his local chip shop. 28 years on, Ryan writes about gaming for Micro Mart. He's still addicted to chips and still useless at *Galaxian*

Konami: Game Over?



Metal Gear Solid V has launched to huge acclaim, but it could also be the end of an era: with Konami's slate now clear, it's claimed that its days of triple-A games are over.

This week, Ryan laments the possibility of Konami ceasing major game development, and looks at the new features coming up in Street Fighter V...

Plug & Play

At the time of writing, *Metal Gear Solid V: The Phantom Pain* has received universal acclaim for the depth of its open-world stealth. This is, after all, a game where guards don't just respond to your presence as you sneak around, but alter their behaviour based on your past strategies. Have a tendency to take out guards with head shots? The next time you visit the enemy base, you may find they've taken to wearing bullet-proof helmets. Enjoy tip-toeing up behind guards and taking them out silently? Soon, they'll start walking around in pairs to better protect themselves.

The Phantom Pain hasn't enjoyed the smoothest path to release, with a very public falling out between director Hideo Kojima and publisher Konami. However, the game's positive reception and the solid sales reported so far suggest that the series' remarkably consistent quality has remained unchanged.

The Phantom Pain felt like the end of an era on release, though, with Kojima parting ways with both *Metal Gear* and Konami. That feeling appears to have been borne out by recent reports; the French website Gameblog first broke the story that Konami is to stop making 'triple-A' games like *Metal Gear*; instead, Konami will focus its energies on the mobile market and its other business interests, like its chain of fitness clubs in Japan.

This story has since been supported by contacts at other websites like IGN and Gamespot, and it's fair to say that evidence for the move has been building for some time. In recent months, we've seen Hideo Kojima's internal production team disbanded and the game it was working on, the survival horror sequel *Silent Hills*, abruptly shut down. In May, Konami's CEO Hideki Hayakawa uttered the widely shared soundbite that "Mobile is where the future of gaming lies", a sentiment that may, reports suggest, have led to long-serving technology director Julien Merceron to leave the company.

It's certainly the case that, with *The Phantom Pain* and *Pro Evolution Soccer* now released, Konami has no major titles on its slate. So what does this mean for *Metal Gear*? Well, Konami was making positive noises about a sixth game – made without Kojima's involvement – back in March. The decision to go ahead with that sequel will no doubt hinge on the success of *The Phantom Pain*; the game managed to sell around 3m copies in its first week of release, but is still two to three million copies short of making back its hefty $80m budget. For now, we're left with Konami's May statement that, "Our main platforms will be mobiles", and the idea that the next time we see *Metal Gear*, it may well be on a smartphone.

Online

Looking back, it's hard to believe that producer Yoshinori Ono once had a tough time convincing Capcom to let him make *Street Fighter IV*, but convince them he did. The effort was more than worth it; that 2008 entry revitalised the series with its 2.5D combat and satisfyingly precise controls. Suddenly, a franchise that seemed stuck in a creative rut at the dawn of the millennium was given a new lease of life.

With the forthcoming *Street Fighter V*, Ono has a tough act to follow. His vision for a bigger and better *Street Fighter* led to a statement that has intrigued us ever since it was published in *Edge* magazine back in April. "Now we want to create something nobody is expecting," Ono said. "It's going to be a title that caters to fans, of course, but one that also invites completely







▲ ***Street Fighter V will introduce the Capcom Fighters Network. It's a mixture of social hub and matchmaking lobby that could help endear the game to the eSports crowd***

new players onto the scene. *Street Fighter IV* was about reviving a passion. *Street Fighter V* is about growing that passion."

More than six months later, we may be starting to find out what this thing "nobody is expecting" might be. Capcom has announced something called the Capcom Fighters Network, a platform the publisher says will be "directly built into the online infrastructure of *Street Fighter V*."

It's the kind of thing we've seen in racing games and shooters, but is something of a first when it comes to brawlers. Among the things we'll see in the Capcom Fighters Network (or CFN to its friends), are an online world map, where we'll be able to see "where battles are happening all over the world", plus lots of player profiles and stats. Most importantly of all, it will serve as an online matchmaking lobby, where we'll be able to send battle invitations, keep an eye on rivals, register friends and keep up to date on the latest tournaments.

It is, in short, a means of creating a global sense of competition in what has always been primarily a two-player game. *Street Fighter* may have its roots in the arcade – *Street Fighter II* created a brief new golden age for the arcade in the 1990s – but the series' future is assuredly online. With CFN, Capcom clearly hopes to secure *Street Fighter V* as a go-to eSports game, with the platform also allowing users to watch other players' fights and replays. We'll also be able to drill down and discover some properly nerdy information about our own progress and that of our opponents; want to know how many light punches you landed, or what your most commonly-used combo is? CFN will have the answer.

The franchise may be more than a quarter of a century old now – the original came out in 1987 – but its ability to keep reinventing itself and moving with time and technology means that, with *Street Fighter V,* Capcom's classic brawler may still have a bright future ahead of it.

Street Fighter V is due out in the autumn of 2016.

Incoming

Ever since *Braid* came out, we've been awaiting Jonathan Blow's next game, *The Witness*. Designed as a major leap forward from the 2D platforming of *Braid*, *The Witness* offers a 3D island of interlocking puzzles, where simple little mazes soon give way to brain-melting challenges. According to Blow, it's grown into something intimidating that he told PlayStation blog could take as long as 100 hours to navigate.

The game's atmosphere seems somewhere between Croteam's *The Talos Principle* and *Myst*, with a sun-drenched island playing host to all kinds of cruel mysteries. Unfortunately, we'll have to wait until January next year to play it.







▲ ***One of our most anticipated indie games on the horizon, The Witness is the next game from Braid creator Jonathan Blow. He estimates it'll take a whopping 80-100 hours to complete***

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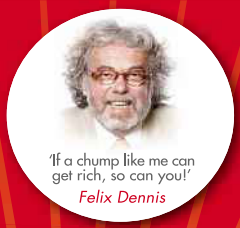
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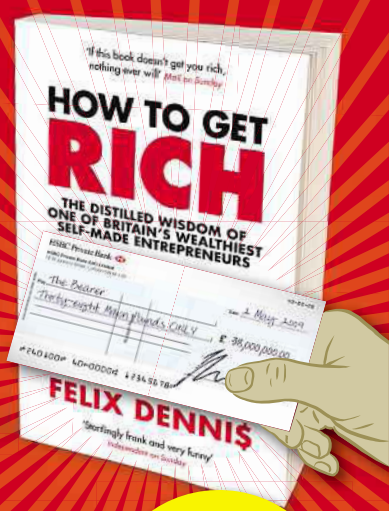


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Simply fill in the form & post to:

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Write the wording for your advert in the numbered boxes below (one word each box). Maximum 30 words free.
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1	2	3	4	5
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11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30
31	32	33	34	35
36	37	38	39	40
41	42	43	44	45
46	47	48	49	50
51	52	53	54	55
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Complete all fields of your personal details and payment method.

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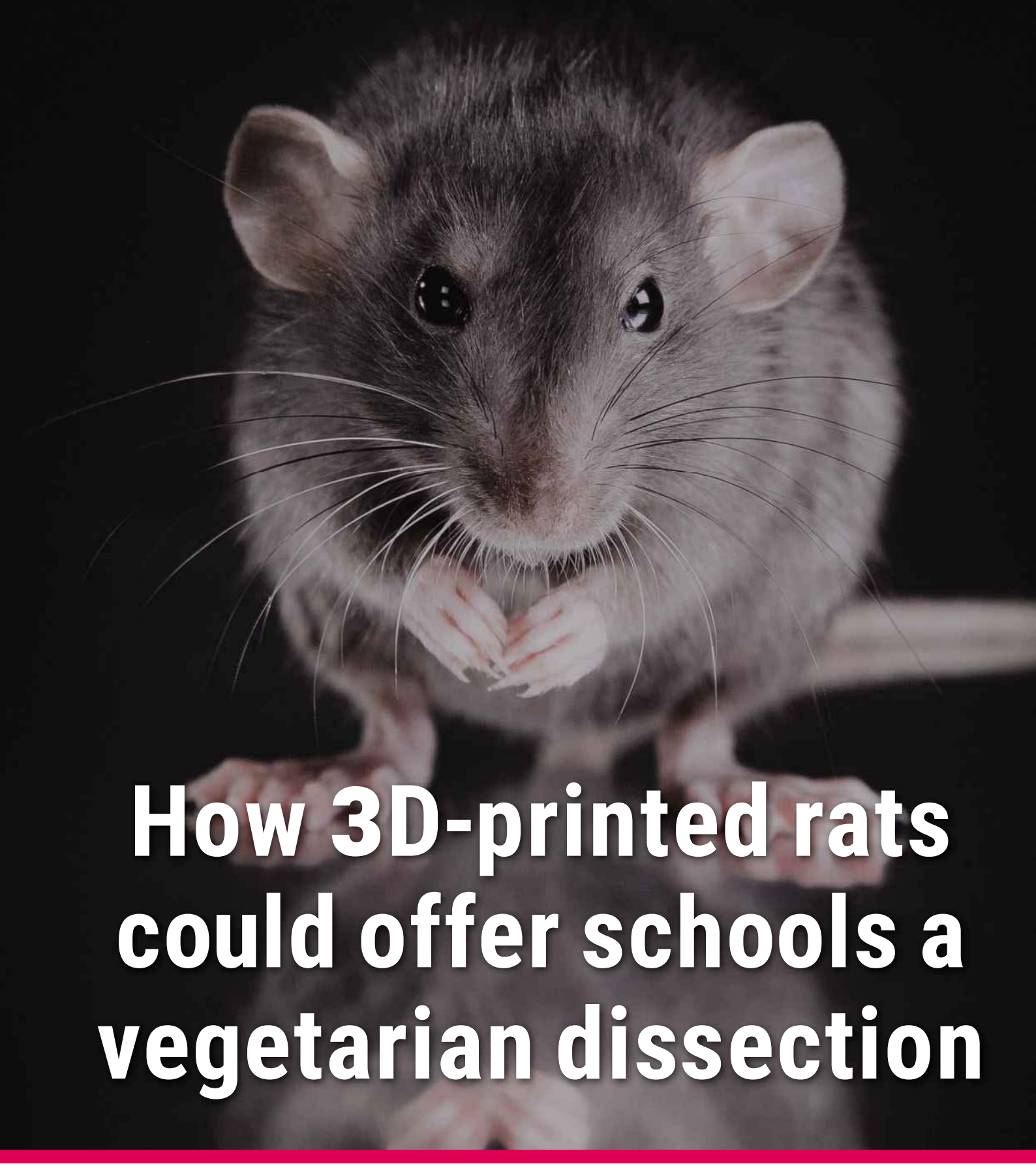
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WANTED: Corporate / ex-business PC's and some printers (in working order) required for a registered charity to redeploy to a new primary school in Nigeria. Preferably free or at very low cost. Thank you.
Email: KG_Earl@hotmail.com

WANTED: PC Tower case (beige colour if possible) to rehome an Amiga A1200 vintage computer. The Amiga motherboard is H 410mm x L 190mm (H 16" x L 7.5"). PSU not an issue but if available 250 watt more than enough.
Tel: Bill (07742) 061569 or (02641) 769503.

WANTED: Fractal Design Define XL full tower case. R1 (original version) in black.
Tel: (01670) 860146
Email: mm@tectron.co.uk

SOFTWARE FOR SALE

Do you have old software that you simply don't use? Why not advertise with us?

Microsoft Office 2000 standard. Upgrade retail box only PART NUMBER 021-02661 £15 NEW AND SEALED. This includes the following WORD, EXCEL, OUTLOOK, POWERPOINT. If you need an upgrade path I can supply one for free. Please add £3 for p&p.
Tel: Dave Thomas (07828) 982930 or (01942) 706571
Email: davethomas96@aol.com

Microsoft Project 2000 retail boxed new unopened box. ONLY £20. Includes Microsoft Project Central and server software. Perfect to upgrading to the latest software at a fraction of the cost. Please add £3 for p&p.
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Email: davethomas96@aol.com

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Email: a2345@btinternet.com

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Email: a2345@btinternet.com

Sim City 2000. Boxed and original. Classic gaming. £15.
Tel: Gordon (01314) 660205
E-mail: scobieg09@gmail.com

SOFTWARE WANTED

Wanted: Driver disc for Toshiba L30-11D PSL33E laptop. Laptop useless without drivers but only worth £40, so cannot pay a lot.
Tel: John Udall (01384) 824494
Email john.udall@blueyonder.co.uk

Wanted: PictureToExe software, for making picture shows.
Tel: (01202) 610602
Email: ivor.mary@talktalk.net

Wanted: Quicken 2001 UK Edition. I need to reinstall the program, but have lost my original installation CD.
Email: david.maddams@icloud.com

IMPORTANT BUYING ADVICE

We work very hard to police our classified ads, and make them as secure as possible. However, please do your bit too and use the following guidelines:

• **Never - NEVER -** pay by bank transfer or post out cash, unless you know the trader already, or are sure it is okay to do so. Pay by cheque, Paypal, Nochex etc wherever possible.

• Be wary of anyone who insists on you paying by the above methods if in doubt, get us to check them out by mailing editorial@micromart.co.uk

• Keep copies of all correspondence

• When sending out goods, at the least obtain a certificate of posting from the Post Office

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ASK AARON



Meet Aaron Birch. He's here to help you with any general upgrading, software and system building problems. He's got advice aplenty, and you're very much welcome to it!

Send your questions to:
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Dennis Publishing
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London
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Contact Aaron by email at:
aaron@micromart.co.uk

Please try to keep your queries brief and limit them to just one question per letter, simply so we can squeeze in as many as we can each week. Please include relevant technical information too.

Aaron

Outta Space

I'm running a Windows 7 desktop (AMD A-10 6800K, 8GB RAM) but the problem is hard disk space. The 250GB SSD C drive is near full. There is a 500GB spinner in the machine as well, where I store documents, videos, etc, but many applications (such as Dropbox, games, etc) seem to default to installing on C and either can't or won't take advantage of the space on the spinner. Can you offer any advice on how to better manage programs and data across the two drives, or is the only solution to buy a larger capacity boot drive?

Appreciate any help you can give, keep up the good work on the mag.

Dan

As I'm sure you've found, once SSD drives become full to capacity, their performance slows down considerably. For this reason it's important to keep plenty of free space. This is why a lot of SSD users make sure they don't install programs on SSD other than the OS and important system apps, and store data on their older, and usually larger, mechanical drives.

For your space conservation, there's not really any need to buy a bigger drive, I'd just suggest you make sure you use the custom install option for apps to change the install location to your non-boot drive. Many apps will let you alter data storage space, so be sure to make use of this, and shift default save locations from places such as the users folder, to an off-SSD location.

Dropbox's use of drive space is a little complex, as it synchronises its various folders, and uses HDD space for this task. You can combat this by using selective sync. To do so, click the Dropbox icon on the system tray, click the cog icon and select Preferences. Under the Account tab click Selective Sync. Here you'll be able to choose which folders are synchronised, thus saving space on your hard drive.

If you have a lot of programs that save data to folders like Documents in your user account, move these to another drive. You can do this by simply right-clicking the folder in Explorer and going to the Location tab. Set the folder's home to be on your mechanical drive, and click OK.

You can also move your actual users account to another drive, taking care of the storage of data programs tend to do within hidden system folders in this location. I provided this solution a couple of issues back, but this focused on Windows 8. For Windows 7, it's a little different. Before you begin, I'd suggest you backup your important data and create a restore point.

When you're ready, boot up with the Windows 7 disc and proceed through the options and select Install Now and then Repair your computer. When you're asked if you want to repair and restart, select No. Windows 7 should be listed as a possible recovery target, so select it and press Next. When you can do so, open a command prompt.

Now you need to note the SSD drive letter (probably C if it's your OS drive), your mechanical drive letter, and the virtual drive used by the installer. Note that the virtual drive may override this, and it may be C, while your real OS drive may be bumped to D, so double-check. At the command prompt we'll copy your users directory to the new location (in this case, your mechanical drive).

First, to copy your users folder, use the robocopy command. As an example, 'robocopy /copyall /mir /xj C:\Users D:\Users' would copy the users folder from C to D. Make sure you include the switches /mir and /xj. The first instructs the system to create the required folders and permissions, and the second tells it to ignore existing junction points. This is essential.

Now you need to delete the old users folder. Use the command 'rmdir /S /Q C:\Users, replacing the C drive path with your own, of course.

Now, we need to create new junction links to the new Users folder. Use the command 'mklink /J C:\Users D:\Users.' The switch /j will create the new junction links.

With this done, you should now be able to manually navigate to the new Users directory, and when you reboot, it'll be on the new drive, and no longer taking up space on your SSD.

Windows 7's repair install can be useful if you need to move your users folder to save space



It's All Gravy

You've helped several people who have been unlucky with Windows 10 installations lately, so how about helping someone who's been plain stupid?

The Sunday morning before last the Windows 10 flag appeared, and I clicked on it to make a reservation. I was immediately offered the download, and I accepted, downloaded and installed – fine! Next to set a password. At this juncture my wife called out that lunch was nearly ready, and it was time for me to make the gravy. I shouted back "Just a moment, light of my life" (or words to that effect), and quickly set a password. After lunch (and the washing-up), I sat down to try out the new operating system. Problem. Can't remember the password. I've tried dozens of combinations that meet my reminder, but no joy. I've no idea what to do next – can you be of assistance, please?

John

Everyone forgets passwords from time to time, John, and gravy is a very important thing on a Sunday. Don't worry, though, there are ways around your predicament, and you should be able to regain access to your account.

The first, and easiest method to try would be to use Microsoft's Password Reset Tool. To get to this, simply go to ***account.live.com*** *and click the forgotten password link. You'll be taken to the sign in problems screen, and from here you can choose the option 'I've forgotten my password' and reset it. This should hopefully sort you out.*

If this doesn't work, there's a longer, fairly complex method we can use, and it involves booting from your Windows 10 media, be it a CD or an ISO image and creating a new admin account that can then be used to reset the password on your locked account.

To begin, boot up from your Windows 10 media and when the setup process begins, press Shift+F10. You'll now see the command prompt, which we'll use to replace the Utility Manager with the command prompt at the logon screen. To do this, first type:

move d:\windows\system32\utilman.exe d:\windows\system32\utilman.exe.bak'

Press return, and then type:

copy d:\windows\system32\cmd.exe d:\windows\system32\utilman.exe

Press Return. With this done, type:

wpeutil reboot

This will initiate a reboot, when the PC reaches the logon screen you should get a command prompt. It's time for a couple more commands. First, type:

net user USERNAME /add

Press Return, and then type:

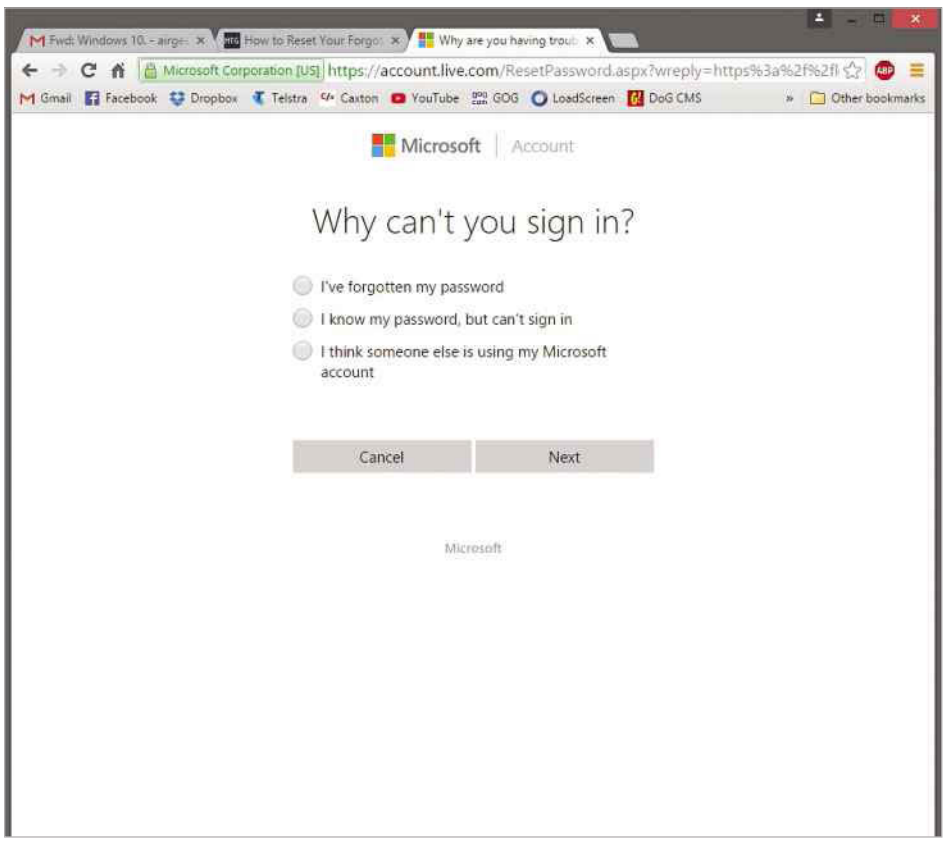
net localgroup administrators USERNAME /add

Note: replace USERNAME with whatever name you want to give the account, and then press return. Reboot, and the new user you just created should be selectable, and it'll have full admin access. Pick it and when you get to the Windows Desktop, right-click the Start Menu and go to Computer Management. Expand the section Local Users and Groups and right-click the locked account. Choose the Set Password option and then input some new details, hopefully ones dinner won't distract you from. Reboot, and you should be able to log on to your old account as normal.

A caveat to this method is that it'll only work with local accounts, for Microsoft Live accounts, you'll need to use the first method, or contact Microsoft. Bear in mind that your new admin account should also be able to access all folders on the system, including other users' folders, so you can still locate and access your important data for your locked user. Good luck.

"Reboot, and the new user you just created should be selectable, and it'll have full admin access"

If you forget your account password, you can usually recover it easily online



ASK JASON



Meet Jason D'Allison, a veteran of Micro Mart's panel of experts. He's here to help with any technical questions, including anything to do with tablets or smartphones, as well as PCs

Send your questions to:
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Contact Jason by email at:
jason@micromart.co.uk

While we try to cover as many questions as we can, we regret that Jason cannot answer your questions personally, but he'll cover as many as he possibly can each week. Please ask one question per letter and remember to include the full specification of your computer, including its operating system.

Jason

Unlucky Seven

It's fallen on me to fix my nephew's second-generation Nexus 7. When booting up, the tablet hangs at the Google logo. This started immediately after an OTA update (over-the-air). I can access the recovery menu – via the power and volume-down button combination – but none of the options does anything. I've also tried NRT (the Nexus Root Toolkit) in the hope of unlocking the bootloader and performing a reset, but even though Fastboot connects and displays the correct serial number, it gets stuck indefinitely when I attempt to clear the tablet's caches. Help!

Paul Williams, Outlook.com

You've tried most of the things I would've recommended, Paul. Have a crack with the Unified Android Toolkit, though. This is like NRT but it's even more laden with features. About the only thing it can't do is deliver world peace. Here's the download page: ***goo.gl/0kcB50****. The free version should be all you need.*

I'm not optimistic, I have to say. Unfortunately, the failure you describe isn't uncommon on the Nexus 7 (2013), and almost always it's hardware-related. I doubt the OTA update was to blame. Updates tend to push hardware at full tilt, so on a device with an underlying weakness, the extra heat can be the kiss of death. In your case, I suspect the update was really just the catalyst, not the cause.

Often, there's simply a loose connection, and many users have been able to coax their Nexus 7s back to life by giving them a sharp wrap on the side or back. Rinse and repeat whenever the problem recurs. In other instances, the fault lies with the I/O controller or the flash storage attached to it. Have you seen error messages stating that certain storage areas can't be mounted? I wouldn't be surprised.

If that's where you're at, the only solution is a mainboard replacement. Expect to pay around £30 for one of those, but you might have to wait a while for one to come up – on eBay, naturally. No special tools are required, just patience and a steady hand. Of course, this won't get your nephew his data back (assuming he's lost anything). Also, a fully working Nexus 7 (2013) can now be bought for around £50, so a repair may simply not be worth the effort.

N.B*. For those interested in entering and using the Nexus 7's recovery mode, here's a useful guide:* ***goo.gl/2XuaiQ****. And to download NRT, head to* ***www.wugfresh.com/nrt****. All the links I've given are also relevant to the first-generation Nexus 7 (2012).*



Please do not adjust your set

Cell Hell

I own a Samsung Galaxy S III smartphone. It's old, I know, but I'm in no hurry to upgrade. I've had it for three years, and a couple of months ago it started shutting down at random. It was also getting hot. I worked out that the battery was kaput – it was swollen in the middle – so I bought a replacement from eBay. However, this has always held a very poor charge, so a few weeks ago I bought another. This has already begun to swell up. Both batteries cost under a fiver, but both were sold as being genuine. How can I be sure the next battery I buy really is genuine?

K. Bayliss, Gmail

You can probably assume that any Samsung phone battery costing only a few quid will be as genuine as a Savile Row suit sold by Trotters Independent Traders. At that end of the market, genuine usually means 'genuine'.

On eBay – Amazon is only slightly better – all you can do is look at a seller's feedback. If there are lots of negatives for the item you're planning to buy, or for similar items, walk on by. This means you could be walking for some time, sadly, before reaching a seller who appears to offer the real deal. Of course, to be absolutely certain of not getting stuffed, head direct to Samsung. A new S III battery in the company's online shop costs £19 (including delivery): ***goo.gl/h8mYQI****. Steep, but not so steep that it's beyond consideration.*

My own approach when buying batteries – not just for phones but also for laptops and so on – is to go for ones that don't even pretend to be genuine. I figure manufacturers of batteries carrying false branding have something to hide, relying on the brand to achieve sales. Manufacturers of batteries carrying unheard-of Chinese brands must be confident that the product can sell on its own merits. I've no evidence to back this theory up, mind.

Genuine or 'genuine'?



Watching The Clock

I have a self-built media-centre PC, and recently, because of some niggles, I reinstalled Windows. I also updated the BIOS. Ever since, however, I've had nothing but trouble. The PC's specs are listed below.

CPU: AMD A4-3400 (2.7GHz, dual-core)
Motherboard: Gigabyte GA-A75M-UD2H (Socket FM1)
RAM: 3.25GB DDR3
GPU: Radeon HD 6410D (integrated)
Cards: terrestrial TV; satellite TV; sound
HDD: Samsung 250GB
SSD: Crucial 64GB
OS: Windows 7 (32-bit)

The PC will run for exactly one hour before freezing and then producing a BSOD and an emergency file dump. If you'll excuse the pun, this occurs like clockwork. If I shut down the PC just short of an hour, I can then restart it and continue for just short of another hour – and so on. The PC needs to be completely powered off for this to work, though. A simple restart puts Windows into repair mode.

I've tested the RAM – all okay. I've also run 'sfc /scannow' at the command prompt – nothing amiss. What I did discover, though, was that Windows Media Centre's TV guide sometimes showed the wrong programme times. I traced this to the system time, which was jumping ahead a couple of hours after each crash. I solved this by disabling Windows' automatic time-check. I'm still getting those hourly BSODs, however. Where do I go from here?

Bob Valleley, via email

I can't recall ever having come across anything like this before. A very odd problem and no mistake. An alarm went off when I read about the BIOS update, though. A PC's BIOS should be left well alone unless an update is known to fix a prevailing issue or provide support for a new CPU. By the sound of it, that wasn't the case here. I reckon your first task, Bob, is to downgrade the BIOS to the version in place previously.

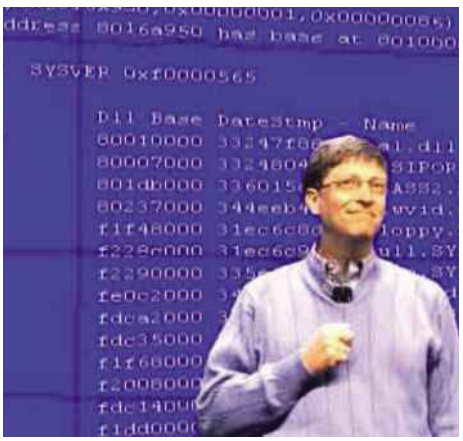
If that doesn't help, replace the motherboard's CMOS battery. The crashes appear to relate to time, and the CMOS battery keeps the board's real-time clock ticking. Admittedly, the real-time clock, or RTC, is only needed when the PC's powered off – it's redundant once Windows is up and running – but who knows? The battery you're after is a CR2032. eBay is the place, where even top-quality ones cost no more than a quid apiece.

Still getting grief? Maybe there's a driver issue with your TV cards. I'd take both cards out and see whether the BSODs vanish. If they do, put the cards back in one at a time. When you find the card that causes all the games, visit the manufacturer's website and download the latest driver. If you're already running it, download an older one.

**Still* having trouble? Well, are you running any scheduling software in addition to Media Center? Maybe this is configured to update its programme guide every hour – Media Center itself could be, too. I think you'd do well to uninstall anything related to the TV cards except their drivers, and make sure Media Center's updates are set to manual. Again, it's a matter of trial and error: reinstall your software piece by piece and fiddle with the settings one at a time.*

Hopefully, some or all of the above will restore the sanity in your life, but if not, I'm clean out of ideas. Can any readers suggest a solution? Please get in touch, and get in touch again yourself, Bob – let us all know how this story ends.

The stuff of nightmares. Most of us don't care for blue screens of death, either...



Crowdfunding Corner

Accessorising existing devices into smart devices is one way to save money. Not only do you avoid replacing perfectly good hardware, you can also reuse the accessories. And that's what this week's Crowdfunding Corner is about…

Skreens

With so many screens in our lives, it seems like it would be useful to link them all up in some way. And that's exactly what Skreens is banking on. The Skreens box allows you to connect a large number of devices to a single HDMI input, and better yet, display all of them on a single display. The Skreens box allows you to resize, scale and mix different inputs, so you can have them side-by-side, picture-in-picture or tiled, depending on what you want to see and when.

The NexusPro unit even allows you to add effects like transparency, cropping, chroma key and layering, so you can stream video with advanced effects. It even has a built-in Chromium browser so you can load content from the web, giving you access to services like Netflix and YouTube. Audio is supported for every input, so you can choose the one you want to hear and stream secondary channels to your phone or tablet. The developer promises a lag-free experience, and you'll never have to swap cables around or even hunt for the right remote ever again.

Early bird tiers allow you to get a Skreens NexusTwo unit for $179 (£118), which combines two HDMI inputs (regular Kickstarter price: $199/£130, which is still $170/£112 off RRP). Higher tiers allow you to get your hands on the NexusTwo PRO, NexusFour and NexusFour PRO models, which have expanded feature-sets and limited edition colours.

URL: kck.st/1iL2ctp
Funding Ends: Sunday, 1st November 2015

Unique

If you own a watch and don't want to shell out hundreds to replace it with a smart watch, the Unique smart watch strap may be for you. The durable leather-style wristband conceals a fitness tracker and Bluetooth system with notification LEDs, so you can have the functionality of a smartwatch with the style and appearance of a regular one.

The strap's five main features include Activity Monitoring, which allows you to track your distance, calories burned, steps and speed; Notifications, which allows you to see when you're getting a phone call or message; Gesture Recognition, allowing you to control your smartphone through your watch (for instance, by rejecting a call with one tap); Loss Prevention, which notifies you if you watch and phone move too far apart; and a programmable NFC tag so you can quickly duplicate NFC communications.

At time of writing you can still get early bird tiers at $139 (£91) or $169 (£111), but the full price for one is $199, available in light brown, dark brown or black. They're due to ship in April 2016 as long as they hit their $50,000 (£33,000) target – and even this early on, that seems virtually certain. Get in quick if you want one.

URL: kck.st/1LyPngl
Funding Ends: Thursday, 22nd October 2015





Disclaimer: Images shown may be prototypes and Micro Mart does not formally endorse or guarantee any of the projects listed. Back them at your own risk!

App Of The Week

Fjuul – Health Activity Coach

We aim to improve our fitness, through some intense Fjuuling

Aside from allowing us to keep in touch with the world 24/7, phones are also becoming personal fitness instructors. Much as a Drill Sargent would, the phone will now attempt to drive us from comforting arms of Morpheus, in favoiur of putting our trainers on and venturing out for a brisk morning jog. It'll catalogue our efforts, note how much we've improved and then tell us what's in the food we're about to consume for breakfast.

Get Active

A Finnish startup company, though, has come up with an app that's head and shoulders above the competition when it comes to fitness related programs.

Fjuul uses a proprietary algorithm and specialised technology to recognise motion based on the data sent back through the device's accelerometer, geo-specific data and other sensor information to determine the intensity of the task you're currently doing. If the levels of intensity are high enough then the impact of the task is recorded via the app and displayed on the Fjuul counter as Fjuul Points.

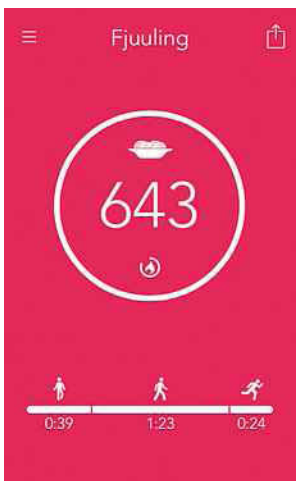
"We've developed Fjuul using a scientific approach to activity tracking, with a focus on the intensity of someone's movements. With Fjuul, it doesn't matter whether you're training for a marathon or walking to or even moving in the shop – every move counts," said CEO and founder of Fjuul, Sascha Wischek. "We believe counting steps, duration or calories just isn't enough when it comes to measuring the impact activity is having on a person's health or levels of exercise. Fjuul understands each user and educates them about what their daily activity means, how it can be maintained or increased to have a positive effect on their overall health."

Go Social

As Fjuul calculates the intensity of the task you're doing, and essentially converts that into an equivalent task – for example, a heavy bout of gardening can be the equivalent of a 15 minute run – you can set certain goals and calculate how those will be attained based on your current activities.Also, you can opt to share those goals to help inspire your friends and family, and too get inspired by other Fjuul users, called Fjuulers.

Features At A Glance

- More than simply tracking steps or calories, Fjuul focuses on intensity of any activity
- The 'Fjuul Points' metric offers a simple way to analyse, improve, and compare
- Sets goals and calculates in real-time how they can be reached
- Runs in the background with lower impact on battery life
- Available on all iPhones due to unique algorithm
- Learn from friends and get inspired socially



Get specifics on how many calories it would take to burn off certain foods



Get the details on how much effort you've put into your day to day tasks



See your Fjuul Points, and how well you're doing

Conclusion

The ultimate goal is to help you understand how your everyday activity helps you improve your health. By analysing daily routines Fjuul hopes to improve wellbeing by making small adjustments to increase the points you accumulate each week or month. Perhaps that's walking an extra few stops on your journey to work, or taking the stairs instead of the lift. It all adds up, and Fjuul will help you calculate and see what the benefits are.

It's easy to use, and doesn't feel like you've signed up for Boot Camp or are now involved in an intensive SAS training programme. So if you're in the market for a new fitness app that's different from the rest, then Fjuul could well be the one for you. Considering it's free, it's worth a try at least. **mm**

Logging Off

This may shock those of a nervous disposition, but the time has come to accept that the Microsoft Zune is dead.

Yes, I know it never actually came to the UK, despite numerous promises to the contrary. And even in the US, Microsoft stopped making and selling the hardware donkey's years ago. However, somewhere in the world, there are people still using them, incredibly enough, but Microsoft has finally called time on the service and their now well-worn devices.

On 15th November, Zune services will be shutting its digital doors, and anyone with music on the platform should download it to their PC for further enjoyment.

Oddly, though, what was once the Zune marketplace survives, now devoid of that specific branding, because in 2012 it became Xbox Music, and then because almost nobody associated music with the Xbox, Microsoft rebranded it again to Groove.

When the Zune first appeared I'll admit to being curious about it, mostly because I'd seen how badly made the Apple products were, and I hoped it might be a plausible alternative. But when the devices appeared they came in dire colours, and their specifications didn't attract the customers like Apple, and the Zune Marketplace wasn't marvellous.

Luckily, there was one light in this tunnel for music fans, and that was the Zune Music Pass. Costing $14.99, a month it gave you access to all of the Zune Marketplace music to stream, and you also got to download and keep ten tracks every month. This might not seem like the greatest deal in the world, compared to, say, Spotify, but some people liked it so much they still have their subscriptions running to this day.

Come mid-November, those with a Zune Music Pass will find that they've smoothly transitioned to a Groove Music Pass, which costs only $9.99. However, the ten free tracks deal ends, so they might want to reconsider that relationship.

In retrospect, what's amazed me about the Zune and its services is how long it's taken to entirely die, given the Zune first launched in 2006. Over that time, Microsoft made four generations of the hardware, starting with the infamous Zune Model 30 that didn't like leap years, and ending in 2010 with the Zune HD.

With limited market penetration and the vaporising sector for dedicated media devices, the hardware towel was thrown in four

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years ago. But incredibly the Zune legacy continues in many strange and subtle ways.

The interface that the Zune HD featured was the starting point for that of the Windows mobile phone OS that eventually influenced the Xbox, Windows 8 and 10. The Segoe font that these all now use also first appeared on the Zune. And that Microsoft logo that emblazons the back of the Surface Pro was first put on the Zune HD.

In this respect, the Zune, although the source of much hilarity among geeks, was an unsuccessful product that contained lots of things that Microsoft was really happy with.

Perhaps that goes some way to explaining why the company gave it so many chances to succeed, and continued its services so long after they were effectively redundant.

Even with two new flagship phones about to be announced, I wonder if that product range will elicit any such sentimentality at Microsoft when it's finally terminated. Somehow, I doubt it.

Mark Pickavance

LAST WEEK'S CROSSWORD

Across: 7 Nervous Wrecks, **8** Plural, **9** Grainy, **10** Helotry, **12** Blitz, **14** Bribe, **16** E-Dating, **19** Screen, **20** Exempt, **22** Magnetosphere.

Down: 1 Zeal, **2** Overdo, **3** Dullard, **4** Swage, **5** Recall, **6** Ikhnaton, **11** Eurocrat, **13** AdSense, **15** Boeing, **17** The Who, **18** Unity, **21** Perk.

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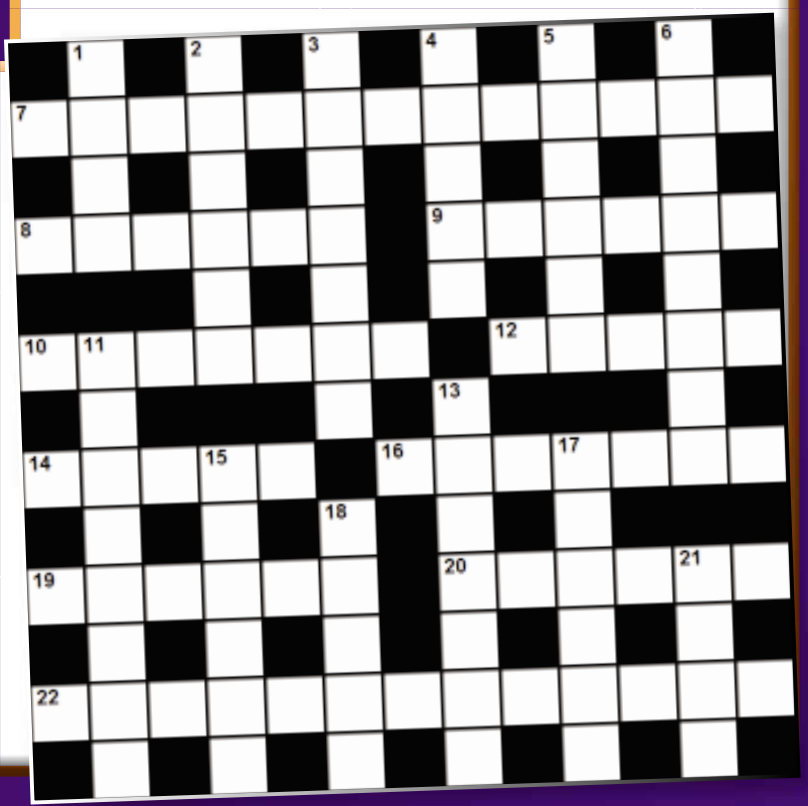
THIS WEEK'S CROSSWORD

Across

7 PC entertainment applications that involve guiding an avatar to jump between suspended ledges, over obstacles or both to advance towards a goal. (8,5)
8 Regain or make up for losses. (6)
9 An HTML mark-up tag to define a position in a file or a link to a URL. (6)
10 Extend beyond the normal limit. (7)
12 A mercantile establishment for the retail sale of goods or services. (5)
14 A self-publishing platform that enables their users to create, self-publish and market their own print and ebooks. (5)
16 In HTML mark-up the O in 'OL'. (7)
19 A book written by Sir Thomas More (1516) describing the perfect society on an imaginary island. (6)
20 Inform people of something in a formal or official manner. (6)
22 Highly unusual or remarkable. (13)

Down

1 0000FF (4)
2 A short printed or written diagonal line typically separating characters or figures. (6)
3 Make a database file smaller by eliminating unused space. (7)
4 Deliberately attack the good name or reputation of someone. (5)
5 A person or animal adopted by a team or group as a symbolic figure to bring luck. (6)
6 A new or reserve supply that can be drawn upon when needed. (8)
11 A television information retrieval service created in the United Kingdom in the early 1970s by the Philips Lead Designer for VDUs, John Adams. (8)
13 .gd TLD. (7)
15 A written document describing the findings of some individual or group. (6)
17 Not extinct, destroyed or lost. (6)
18 Popular web portal founded by Jerry Yang and David Filo in January 1994. (5)
21 The phonological or orthographic sound or appearance of a word that can be used to describe or identify something. (4)



Top 5 Retro Computing Things We Miss

Sometimes, it's the little things that matter most...

1 20 GO TO 10

Whether you were into coding or not, if you had a Commodore 64 back in the day, there was one little bit of BASIC you were sure to learn: 20 GO TO 10. That wasn't the entire thing, but if you ever used it, you'll probably know the rest. What really mattered, though, was the result: a chosen word or phrase repeated infinitely down the screen. And, of course, if you had an older brother, that phrase was usually something unflattering about you. Good times.

2 3.5" Floppy Disks

No, we don't miss the tiny storage space (normally 1.44MB) or the slow access speeds (around 124Kbps), but we do have fond memories of one particular things about this technology: the springy metal bit that covered the disk itself. Obviously, this performed an important and useful function, but what we remember most about it was playing with it, springing it back and forth when we were bored. Also, it turns out you can make something that looks a bit like the Starship Enterprise with it too: **youtu.be/B42ZG8-zr-Q**.



▲ *Wow, it's like he's actually in the room!*

3 Using A TV

One of the greatest things about computers like the C64, Amiga, Spectrum and so on was the fact you could hook them up to a normal TV – no need for a dedicated monitor. Of course, modern TVs have once again made this possible, but it's not the same experience, because instead of connecting your computer to the family TV for everyone to enjoy, the low price of screens means there's no reason not to have a dedicated display for your system. Where's the fun in doing 20 GOTO 10 if it's not in the living room where everyone can see it?

4 Loading Screens

Loading up a game from a tape wasn't exactly fun. It was slow and you often had to watch a bunch of scrambled colours appear on your TV, sometimes accompanied by horrible squealing noises. One thing that made the wait a bit more bearable, however, was the loading picture. There were many great pictures (and you can see some at **tinyurl.com/mmtop582**), but the one we always remember was for *RoboCop* on the C64 – not because it was particularly remarkable (at least not looking back at it now) but because someone once said to us, without irony, "Wow. It's almost photographic."

5 Loading Games

Because loading games via tape took so long, a few developers took pity on gamers and came up with the idea of offering smaller games that loaded up before the main attraction. Again, though, we're thinking of a specific C64 title: *Ghostbusters* from Mastertronic. Like many of this publisher's C64 games, it featured the Invade-a-Load fast loader routine, which meant you could play a version *Space Invaders* while you waited. There were other such loading games from other publishers, but this was our favourite, and it helped pass the time until floppy disks and that springy metal bit came along.

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